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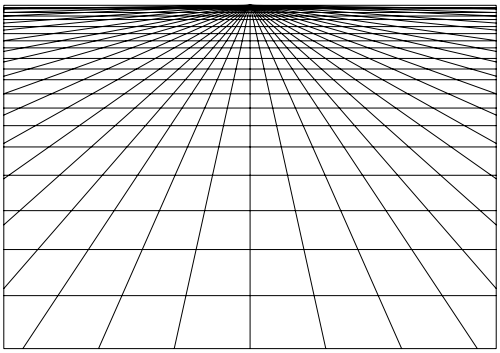

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Challenges and Opportunities for the Use of the Internet in Higher Education - Indonesia Case Study

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In memory of Gudfrid Wetlesen

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ABSTRACT

The objective of this thesis is to examine the role of the Internet in knowledge processes at three universities in the South. Building on theories on knowledge transfer and knowledge creation, the thesis develops a conceptual framework for analyzing knowledge processes where the Internet is involved. The study focuses on three main aspects: The Internet used to acquire knowledge, to share knowledge and to build and maintain networks. In addition the study identifies and discusses factors that influence on how a researcher uses the Internet. Based on qualitative interviews with 25 researchers at three different universities in Indonesia the analysis shows that the Internet *can* be a main information source, but this is depending on the researchers' background and network, and also on easy access to Internet facilities. It is further revealed that the use of the Internet for publishing of own research work is limited and arbitrary. The analysis also shows that email and mailing lists are highly important tools for maintaining an international network.

Keywords: research, developing countries, Internet, knowledge, Indonesia

ACRONYMS

ESST	European Studies of Science and Technology
IAIN	State Institute of Islamic Studies
ICT	Information and Communications Technology
LDC	Least Developed Countries
NIS	National Innovation System
OECD	Organization for Economic Co-operation and Development
UI	University of Indonesia
UNESCO	United Nations Education, Scientific and Cultural Organization
WWW	World Wide Web

1 INTRODUCTION

This study is motivated by the high focus on the role of knowledge as a prerequisite for economic growth and the importance of information and communication technologies (ICTs)[1] in this context. OECD's report "The knowledge-based economy" (1996), the World Banks book "Knowledge for development" (1998) and UNESCO's book "Towards a Knowledge society" (2005) are just a few examples of literature focusing on knowledge and emphasizing the importance of ICTs in knowledge creation and diffusion.

The World Bank argues that ICTs are a basis for both building and applying knowledge. In a world where knowledge is a main driver of increased productivity, the World Bank fears that the gap between rich and poor countries will widen with a delayed adoption of ICTs (World Bank, 2002). ICTs are indeed playing a central role in the global knowledge economy. Thanks to ICTs information can now be processed and analyzed with a speed and accuracy that before was impossible. Similarly information can be exchanged faster, cheaper and more accurately. As a result new knowledge is created at a higher pace than ever before. On the other hand a lack of skills and capital in developing countries hinders the diffusion of ICTs and contributes to what is known as the problem of a *digital divide*, a division between those who

[1] The World Bank's (2002 p.3) definition of ICT is "hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of information (voice, data, text, images)" is adopted in this study.

have and those who have not a possibility to benefit from the resources of modern ICTs.

Among the ICTs the Internet is arguably the most important when it comes to knowledge creation, knowledge sharing and networking. The Internet is getting more and more important as a medium for information exchange. It is a virtual library where a significant share of the world's written information can be found. Additionally the Internet is used to disseminate own research and for participating in research networks. This way it may promote globalization in academia and help to democratize access to information. Access to the Internet and electronic libraries is of high importance for universities around the world. This research examines how the Internet is influencing knowledge creation, knowledge sharing and networking through case studies at selected universities in the cities of Jakarta and Banda Aceh in Indonesia.

1.1 Background

Universities have a major responsibility for knowledge creation and knowledge transfer; therefore it is of significant interest to follow how they use the Internet to this end. To shed light on how the Internet is used among academic staff can be educative in itself, but it can also emphasize obstacles that should be addressed in order to improve the usefulness of the Internet in this particular environment. A qualitative description of the integration of the Internet in the work of academic staff will give insight that can have implication for higher education policy and for prioritization of ICTs in development programs. To the author's knowledge few similar studies have been conducted previously. Two exceptions are a quantitative study from China

(Dong, 2003) and a study on the use of the Internet at research institutes in a group of African countries (Okunoye and Karsten, 2003). Those studies have described the use of the Internet, but not gone into how the use of the Internet actually contributes to knowledge transfer and knowledge creation. In addition studies conducted by Wesley Shrum (2004, 2005) have focused on the use of the Internet for scientific collaboration and the Internet's impact on research productivity.

Empirical data has been gathered at universities in Indonesia through interviews with academic staff at three universities. One of the universities is the prestigious University of Indonesia, the two others in the province of Aceh. The University of Indonesia is included in order to compare a relatively resourceful university with provincial universities, and to have a national benchmark that gives insight to the possibilities available in a country like Indonesia. Of the two universities in Aceh, only one has facilities for accessing Internet. A comparison of the two is illuminating for an understanding of the Internet's role and importance for knowledge processes[2].

[2] By knowledge processes is meant: acquiring information, conducting *research*, sharing research results and participation in research communities. A definition of research is: "investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws." (Merriam-Webster Online Dictionary, http://www.m-w.com/dictionary/research, accessed on 01.08.06) This definition includes application of new theories, which is important this context. As resources are scarce, higher education in the South will often focus more on application of new discoveries than making of those.

A main reason for choosing universities in Aceh for this case study is that I have some general knowledge about the area and I have a network there.[3] That said I believe universities in Aceh are representative for universities in developing countries' less favored areas. Ridden by decades of armed conflicts, Aceh is a weakly industrialized province where fishing and agriculture are the main economic activities for about half of the population (FAO, WFP 2005). About 53 per cent of the Indonesian population lives on less than US$ 2 per day (FAO, WFP 2005). Although resources allocated to education and universities do vary largely among countries in the South, the setting can be seen as typical for many developing countries: lack of financial resources is chronic and the level of economic development is low.

I find it especially important to investigate a university in a small city in a province. The few other similar studies I have encountered tend to focus on universities in capitals and bigger cities where in many cases a country's most developed universities are found. Those universities are probably not representative for universities in less developed areas.

[3] I spent one year in Aceh after the 2004 Tsunami working with ICT for a humanitarian organization. Experiencing the benefits of the Internet and also its limitations in this area during daily work has been an important source of inspiration for this work.

1.2 Objectives and research questions

This subchapter first presents objectives and research questions for the thesis. Thereafter a justification for the choice of subject is given. The objectives of the research are:

- To examine the role of the Internet in knowledge processes at universities in a developing country context.
- To identify the benefits that the Internet introduces for knowledge flows in this setting and factors which hinder efficient use.
- To propose elements that should be given priority in the studied universities' ICT policies.

Based on this the following research questions are formulated:

- In what way is the Internet involved in a researcher's knowledge acquisition, knowledge sharing and creation and maintenance of a professional network?
- What are the factors influencing on a researcher's use of the Internet seen from an individual and an organizational point of view?

These questions are sought answered through an analysis of 25 interviews of researchers employed at three different institutions of higher education[4] in Indonesia.

The research questions give a clear direction for the research to be done and the introduction builds up under the relevance of these questions. They are dealing with

[4] As *higher education* I adopt the understanding presented by UNESCO (2005, p. 95) as a place where, in addition to teaching, "production and development of new knowledge in cultural, social and economic spheres" take place. This understanding includes *research* as an activity, and thereby excludes institutions offering training without having any research activity.

the day-to-day life of researchers working in an environment that has or will be significantly changed with the introduction of the Internet.

The results of this study can be an important input to policy makers for strategies on ICT development. Findings should be taken into account when making policy for ICT investments in higher education. The study will hopefully contribute to a better understanding of the actual use of the Internet for researchers in less privileged universities, and through that motivate actions that can further improve the efficiency of the Internet in this context. In itself the study may also be educative for researchers with the consequence that they will have a more conscious attitude to the use of the Internet in a research context. In addition the thesis will provide a snapshot of the current international cooperation taking place in the universities studied and thereby give a contribution to the study of globalization of universities. Finally the answers to the research questions may also have significance for knowledge workers in enterprises and public sector involved in learning, teaching and research.

1.3 Limitations of the study

The research subjects are limited to academic staff, students use of the Internet is not considered in this study. This is a choice done in order to narrow the focus of the research. According to Dong's research (2003), a higher educational level of the user gives a higher feeling of usefulness of the Internet. This indicates that academic staff has a more conscious way of using the Internet and thus probably also will benefit more of the Internet. For this reason I find it more rewarding to investigate academic staff than students.

Further on, distance learning through the Internet is not a part of this study. There are indeed interesting distance learning projects going on in Aceh. For example is Syiah Kuala University participating in a research consortium called WIDE (initiated by a Japanese university) together with 40 other universities and a number of companies. Since I focus more on researchers than students, distance learning through the Internet is left aside.

Given the time and travel limitations for this research project, it was not possible to follow the research subjects over time. This is unfortunate because knowledge processes evolve over time. This research relied on the stories told by the interviewees. The time frame in question is from the introduction of the Internet up to today. Time and travel limitations also allowed the inclusion of only three universities in two different cities.

1.4 Outline of the thesis

Chapter one serves as a general introduction to the study as it explains the motivation for the study and provides the research questions that will be answered. *Chapter two* introduces the reader to the knowledge theories applied in the study and link those to the use of the Internet. *Chapter three* presents the methods used in the collection and analysis of data. *Chapter four* gives a background to the empirical context of the study: higher education in developing countries is discussed and previous studies of ICT in this setting are presented. In *Chapter 5* the results from the case study are

presented and discussed. Lastly, *Chapter 6* is the conclusion, where also suggestions on policy measures and recommendations for future research are presented.

2 THEORETICAL FRAMEWORK

2.1 Introduction

This chapter provides the theoretical background and the conceptual framework for the study on Internet use among researchers at universities in Indonesia. The study aims to identify and analyze knowledge processes and the role that the Internet have in these. The chapter is organized as follows: After an introductory section on knowledge in a historical perspective there will be a presentation of theories developed for analyzing knowledge and knowledge processes.[5] Then a section combining knowledge theories and use of the Internet follows. Thereafter I suggest a new overall model linking the elements of a knowledge process.

2.2 Knowledge in a historical perspective

This section first presents a brief summary of the history of the concepts of knowledge, skills and technology. The second part addresses how economists have seen the importance of knowledge for economic growth.

Drucker, who first introduced the term 'knowledge society' in 1969 (UNESCO, 2005) summarizes how the term knowledge has changed meaning and appliance throughout history in the article *'The rise of the knowledge society'* (Drucker 1993). Greek

[5] The literature reviewed has been selected from a list of about ninety articles. Those articles were mainly identified through searches on Google and the Swedish universities' electronic library, Elind. The keywords used for searching have been: LDC, Internet, university, research, developing countries, academia, digital divide, knowledge and higher education. Google searches have been limited to specific sites belonging to United Nations, the World Bank and OECD. Articles and reference lists from the literature of the ESST study have been browsed to identify authors with work relevant for this thesis.

philosophers thought of knowledge as spiritual growth of a person (Plato's view) or as rhetoric skills (Protagoras' view). The word *techne* was used for skills, and skills could only be learnt as a trainee of a master and the masters kept their methods secret for the public.[6] Not before the first technical schools were established in France in the 18th century, a systematic way of teaching skills to a wider public was apparent, and the concept *technology*, a systematic approach to crafts of skills, was invented. In the same century British inventors got patents for publishing their inventions and the first encyclopedia, aiming to describe the knowledge of all crafts, was published in France. Knowledge now encompassed craftsmanship, and it was systematically used to spread technology in the form of tools, processes and products. The industrial revolution was based on this progress. What Drucker calls the *productivity revolution* came with the appliance of Taylor's theory of scientific management where knowledge was used to improve working methods, 'knowledge applied on work' as he puts it. The training of workers in highly specified tasks could be done in a few months time, and by assembly line work complex products could be produced faster than ever before. The success of the productivity revolution reduced the need for manpower involved in production and movement of goods. In developed countries today it is the non-manual workers that matters for economic growth (OECD, 1996), and 'knowledge applied on knowledge' (Drucker 1993) is bringing us towards a *knowledge society*. The steam engine, the combustion engine, the transistor and the computer were increasingly complex inventions. The knowledge needed to make those was similarly more and

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[6] *See* Parry, Richard, "*Episteme* and *Techne*", *The Stanford Encyclopedia of Philosophy (Summer 2003 Edition)*, Edward N. Zalta (ed.), URL = http://plato.stanford.edu/archives/sum2003/entries/episteme-techne/ (accessed on 20.04.06) for a more thorough discussion on Greek philosophers view on *episteme* and *techne*.

more complex, and only a highly specialized working force can invent and produce such advanced products.

Hence, knowledge is becoming more and more specialized and a highly educated workforce is paramount for continuous economic growth in developed countries. The innovations just mentioned, from the steam engine to the computer, have all had immense impacts on the world's economy and this make Schumpeter's claim that economic development is driven by innovations (Fagerberg in Fagerberg, Mowery and Nelson, 2005 p.6) seem correct. However, neoclassical growth theory focused originally only on labor and capital in its attempt to explain economic growth (see Solow, 1956). Technology and knowledge were looked upon as public goods, i.e. freely available. This first approach to describe growth quantitatively is not surprising, size of the labor force and capital investments are relatively easy to quantify, whereas knowledge and technology is not. In order to improve the neoclassical theory factors like human capital, various types of labor and research and development investments have been included to the formulas (see f. ex. Verspagen in Fagerberg et al, 2004). Building on Schumpeter's work, *evolutionary theory* has technology, innovation and knowledge as the central factors contributing to economic growth. What distinguishes it from neo-classical theory is that it "embraces the micro complications of the innovative process and applies a more eclectic approach". (Verspagen in Fagerberg, p. 493) According to evolutionary theory, innovation happens in a dynamic interaction between actors. Furthermore knowledge is not seen as a public good that is freely available for everyone; rather knowledge can be local and tacit (see section 2.3.1).

Indeed, there is an increased awareness of the importance of knowledge in business management writing (e.g. "The knowledge creating company" by Nonaka (1991)), in economic growth theory and in development thinking (e.g. "Knowledge societies" published by UNESCO, 2005). This reflects the increasing complexity in processes, products and services we are experiencing. Consequently we need to have a conscious approach to creation and flow of knowledge which the next section aims to build a fundament for.

2.3 A classification of knowledge and knowledge processes

I keep six honest serving-men:
(They taught me all I knew)
Their names are what and why and when
And how and where and who.

R. Kipling (1892)[7]

The following section presents theories that analyze knowledge and knowledge processes. Later, in subchapter 2.4, these theories will be discussed combining knowledge, knowledge processes and the Internet.

Shin, Holden and Schmidt (2000) list a number of definitions of knowledge from various authors, and summarize that "knowledge is a combination of a process element (…) and information" (ibid, p. 336). They claim that "once information is processed through the user's brain, it becomes knowledge. When the user articulates knowledge with the intent of transmitting it, it becomes information". The distinction

[7] Rudyard Kipling ends his short story about the Elephant Child (1892) with a poem. The citation is the first verse of this.

between information and knowledge is important. One must remember that acquiring knowledge is an activity; access to information alone does not guarantee knowledge transfer. This is why it is important to analyze in depth how researchers benefit from the Internet, it is not enough to look only at connectivity.

2.3.1 Tacit and explicit knowledge

The character of knowledge varies from simple to complex, from concrete to abstract. It is argued that the type of knowledge influences its transferability. In the literature on innovation *tacit knowledge* is understood as knowledge that is difficult to codify. Nonaka (1994) describes tacit knowledge as

> [knowledge] deeply rooted in action and in an individual's commitment to a specific context - a craft or profession, a particular technology or product market, or the activities of a work group or team.

He argues that tacit knowledge is so integrated in the holder of the knowledge that developed models and perspectives are taken for granted and therefore cannot easily be articulated. On the other hand, *explicit knowledge* can be transferred easily because it is possible to codify it by the means of text and graphics (Powel and Grodal in Fagerberg et al, 2005 p.75).

2.3.2 Know-what, -why, -who and -how knowledge

In the article 'The Learning Economy' (1994), Bent Åke Lundvall and Bill Johnson elaborate Rudyard Kipling's poem into a theory and distinguish four types of knowledge: *know-what, know-why, know-how* and *know-who*. Know-what knowledge refers to information or facts. Know-why knowledge answers questions about scientific phenomena. Know-how knowledge enables the holder to produce something. Finally, know-who knowledge is about who knows what and who knows

how to do what. Each of these forms of knowledge has specific properties and can be learnt in a particular way. Know-what and know-why knowledge usually is explicit and can be learnt through reading or lectures. Know-how and know-who knowledge is knowledge that normally demands interaction. Know-how knowledge is typically tacit and learning by working in a skilled environment is how it is transferred. Know-who knowledge develops with time through social contact. This classification of types of knowledge underscores its multifaceted nature, and it can be used as a guide when analyzing knowledge processes. It also reminds us that all these aspects of knowledge should be present in order to have efficient knowledge processes. This taxonomy covers knowledge in a broad manner from information to explanation to appliance and also include a social factor (know who) emphasizing the importance of networking and interactivity.

2.3.3 Knowledge transfer

Knowledge is created and transferred through different kinds of processes. Ikujiro Nonaka is known for his models of 'knowledge creation' as described in the article 'The knowledge creating company" (1994). In the article he presents four ways knowledge is transferred: From tacit to tacit, from explicit to explicit, from tacit to explicit and from explicit to tacit. Tacit to tacit knowledge creation is possible through *socialization* which can only happen when people work closely together. When tacit knowledge is acquired it can in some cases be *articulated* in a detailed written form and thus shared. Explicit knowledge can be *combined* with other explicit knowledge to obtain new knowledge that might be in the form of a process, a service or a product. Finally, knowledge is *internalized* when workers and customers take it into

use and add it to their tacit knowledge. Nonaka points out activities involved in knowledge creation: learning, describing, synthesizing and practicing.

How easily knowledge is transferred does not only depend on the knowledge itself, but also upon the actors involved and the character of their relationship. Knowledge can float more easily between actors who have had an alliance for a longer period of time where they could develop better communication and understanding.[8] Furthermore the knowledge base of each of the actors is crucial; knowledge will be passed on with more difficulty if references and competences are too unlike. This is closely related to the term *absorptive capacity* introduced by Cohen and Levinthal (1990) which describes the ability an actor has to recognize, assimilate and apply new information. This ability is "largely a function of the level of prior related knowledge" (Cohen and Levinthal, 1990 p.128). Finally it must be remembered that knowledge transfer difficultly will happen without a motivation from the parties involved. The motivation can come from the existence of complementary knowledge bases that when exchanged gives benefit to all of the contributing parts (Powel and Grodal in Fagerberg et al, 2005 p.75).

Recapitulating we note that efficient knowledge transfer is facilitated by three factors: 1) improved understanding as a result of a continuous communication, 2) the existence of a common references and competences and 3) complementary knowledge bases motivating exchange. We observe that the use of the Internet in the setting for

[8] As Powel and Grodal (in Fagerberg et al, 2005 p. 75) put it: "complex tacit knowledge can become more explicit as partners develop a wider bandwidth of communication".

this study poses some challenges related to those factors. When interaction does not happen face to face but through a technological interface, it might be more difficult to establish a broad basis for communication as the specter and interactivity in the communication is somewhat reduced. Where cooperation happens across cultures and between actors in countries with different levels of development, common references and competences might be scarcer. On the other hand, there is a greater chance that complementary knowledge bases exist and this can give a motivation for knowledge transfer to happen. These observations will be useful when investigating cooperation taking place between researchers.

2.3.4 Individual vs. organizational knowledge

When analyzing knowledge acquisition, sharing and networking it can be done on two levels: from an individual's perspective and from an organization's perspective. For this study knowledge process is looked upon both from the researchers view and from the university as an organization's view. Alice Lam (2002) has developed a framework where she takes into account how organizational forms interact with knowledge processes. She distinguishes between *embrained, embodied, encoded* and *embedded* knowledge. Embrained and encoded knowledge refer to explicit knowledge belonging to respectively an individual or an organization. Embodied knowledge is tacit knowledge at an individual level while embedded knowledge is tacit knowledge within a collective. Efficient acquisition and sharing of knowledge, and networking rely on both individual skills and organizational efforts. For example will excellent ICT skills not help the researcher as long as his or her organization does not provide an ICT infrastructure.

2.3.5 Managing knowledge

In knowledge management[9] literature, knowledge management systems shall support creation, transfer, storage and application of knowledge in organizations (Alavi and Leidner in Okunoye and Karsten (2003 p. 355). Through the characterization of such systems, we are reminded of the importance of storing information (or codified knowledge). A systematic effort to store research data and research results is important for future knowledge creation, transfer and application. Codified knowledge stored on the Internet can give a whole community of researchers an easy access to it.

2.3.6 Summary of knowledge concepts

The concepts discussed in the above sections are summarized in Table 1. This presentation of theories concerning knowledge and knowledge processes provides a set of instruments that can be used to analyze how the Internet is being used by researchers in knowledge acquisition, knowledge sharing and networking. They give a vocabulary to identify the type of the knowledge in question and the process taking place. The analysis is done on both individual and organizational level. In next section the Internet as a technology will be discussed, and a description of how the Internet can take part in knowledge processes is provided.

[9] "Knowledge management refers to a range of practices and techniques used by organizations to identify, represent and distribute knowledge, know how, expertise, intellectual capital for leverage, reuse and transfer of knowledge and learning across the organization." (Wikipedia, http://en.wikipedia.org/wiki/Knowledge_management accessed 13.09.06)

Table 1 Classification of knowledge and knowledge processes

Theme	*Concepts*	*Description*	*Articles*
Type	Know-what, Know-why, Know-how, Know-when, Know-who, Know-where	Knowledge can be seen upon asking this set of questions which address various aspects of knowledge. In addition to encompassing information, explanation and application, they also emphasize the importance of connectedness to a network and knowledge about events.	Johnsen and Lundvall (1994)
Creation phases	Socialization, Articulation, Combination, Internalization	The terms describe phases necessary to create, transfer and apply both tacit and explicit knowledge.	Nonaka (1994)
Knowledge and organization	Embodied, Embrained, Encoded and Embedded Knowledge	Depending on the type of knowledge and whether analyzing on a individual or collective level, different types of knowledge can be classified into four groups.	Lam (2002)
Management phases	Creation, Application, Storage	Emphasizes different aspects of handling knowledge from a management point of view.	Alavi and Leidner (in Okunoye and Karsten, 2003)
Transfer	Tacit and Explicit Knowledge	Knowledge that can be codified and transferred is explicit, while knowledge that can only be transferred through learning by doing or close interaction is tacit.	Nonaka (1994), Powell and Grodal (in Fagerberg et al, 2005)

2.4 Linking the Internet and knowledge processes

Economists characterize ICTs as *general purpose technologies* (see for example Parayil, 2005) which indicates that they are flexible technologies that can be adapted to different tasks and settings in virtually all sectors. ICTs in general and especially the Internet have improved the access to codified knowledge through providing improved storage, processing and communications facilities (Ernst and Lundvall, 1997). The properties of the Internet technology make it essential in a university setting, where knowledge is continuously learnt, created, taught and shared.

2.4.1 Know-what,-why,-how and -who knowledge and the Internet

Know-what and know-why knowledge are codified knowledge and available through search engines and specialized databases. Articles are available for free and through payment, but even if the information one is looking for is existing somewhere on the web, it demands skills to localize it. With access to persons with special expertise (know-who knowledge), the most relevant and reliable sources can be located more efficiently. Know-why knowledge can be complex, and often demands expert knowledge to be understood. The Internet gives access to know -what and -why knowledge that can be *combined* to form new knowledge.

Know-how knowledge is, as it is more tacit in its nature, less available through the Internet. Still, for some tasks, especially tasks that are standardized and relevant for many people, much can be learnt through detailed descriptions on the Internet. With the help of those, learning by doing can happen provided that a relevant knowledge base exists.[10]

Finally know-who knowledge, that as we have seen can be important for acquiring other forms of knowledge, is facilitated with communication tools provided by the Internet. Examples of these are newsgroups, email and the last years cheaper (or free) telephone services. Through such tools networks of individuals with common interests can be created, regardless of borders and distances. A criterion for a working network is mutual trust between the participants. Therefore we must remember that while ICTs

[10] There exist specialized IT expert systems aiming to provide know-how knowledge, but those are expensive to implement and maintain updated (Lundvall 2006).

and the Internet play a central role in handling know –what, -why, -how and –who knowledge, it must be seen in a social context. To quote Lundvall (2006 p.7): "[T]he role of ICT can only be to operate as a superstructure that must be built upon a basis of social relationships". Thus the Internet does not eliminate the importance of a network.

Know-what and know-why knowledge become cheaper and more accessible as the Internet provides free access to huge amounts of information. Ernst and Lundvall (1997) argue that with more and more explicit knowledge available because of ICTs, a new type of tacit knowledge becomes essential: skills in searching information efficiently. Presence of Internet facilities is not enough, tacit knowledge on how to efficiently apply the Internet must be acquired. In a wider perspective, as one of the major effects of ICTs might well be an increased speed of change, the need of an efficient learning of both tacit and codified knowledge increases (ibid).

Likewise Marcum (2006) argues that connectivity to the Internet transform the information from being static to dynamic. He notes that theorists have moved from describing an age of information, to an age of knowledge or an age of learning (or *learning society*). A fundamental basis for this learning is the existence of knowledge networks. "An effective knowledge creation (…) depends on linkages and interactions among participants in this process." (Ernst and Lundvall, 1997 p.27) ICTs itself can play a role in this learning by providing connectivity between actors in knowledge-communities, the Internet makes it easier to establish and maintain networks in specific fields of expertise.

2.4.2 Individual and organizational preparedness for the Internet

Turning to the use of the Internet in a university setting I will now make use of Alice Lam's terminology (2002). First, the Internet helps creating *embrained* (individual and explicit) knowledge. The Internet gives a researcher the possibility to acquire the codified knowledge she/he needs. In this case the Internet works on an individual level. At the same time the organization needs to develop *embedded* (organizational and tacit) knowledge so that the individual user can benefit efficiently from the Internet. This is done by creating routines for data security, storage and sharing of data, efficient communication and by securing sufficient access to codified knowledge. The organization needs to build up technical skills and have the manpower and financial resources to establish and maintain the technical infrastructure. At the user level, the Internet demands *embodied* (individual and tacit) knowledge to be used efficiently; each researcher must find an efficient way to use the Internet according to his/her specific needs. This includes identifying relevant databases and network resources. Finally the Internet can be used to *articulate* an organization's *encoded* (organizational and explicit) knowledge through internal and external online newspapers or newsgroups. With the help of Lam's concepts, we have gained an insight into how to have a broad approach to analyzing the inclusion of the Internet in a university setting.

2.4.3 The Internet in an STS perspective

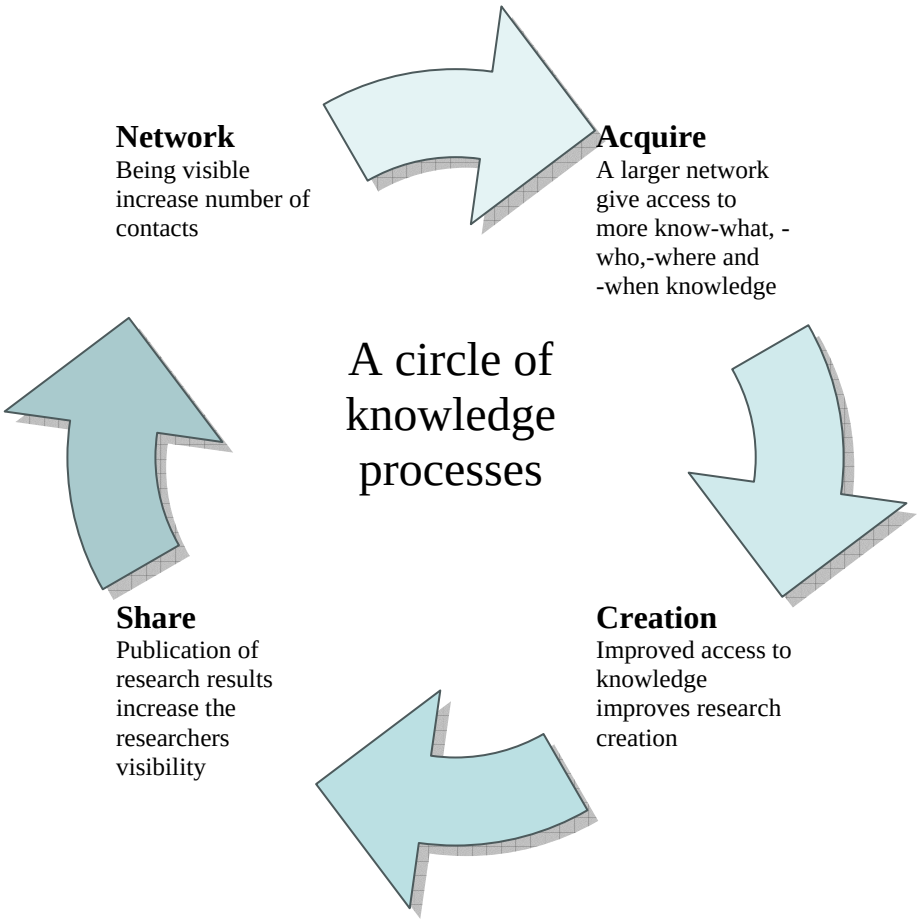
To end this subchapter we remark that the integration of the Internet as a technology can be analyzed using theories from Science Technology and Society (STS) research. With the flexibility of the Internet it is not surprising that the use of it will vary

between different contexts. Technologies are subjected to negotiations between interest groups and also with the technology itself, both in their realization and in their use. This is the important contributions from the actor-network theory (ANT), as propagated by Michel Callon, Bruno Latour and John Law and the Social Construction of Technology (SCOT) theory introduced by Wiebe Bijker and Trevor Pinch (Aasdal, Brenna and Moser, 2001). These theories oppose a deterministic view of technology, where one assumes that the technology itself governs how it will be used and that social context only is a background of technological development, not a part of it. Social, economic and political aspects must be seen as parts of a "seamless web" in which technology develops and is being used. Scarce economic resources, skepticism to new technology originating from religious beliefs, language obstacles are examples of factors that are considered in the upcoming case-study. Which of these or other factors affect researchers' use of the Internet and if so: how?

2.5 Model

To support the analysis of the case study, a simple model linking knowledge acquisition, knowledge sharing and networking is proposed (see figure 1). It illustrates an imagined relation between scientific production and the three knowledge processes analyzed in this study. The model argues that an extensive network potentially can give a researcher access to more knowledge, and supposes that this leads to an improved creation of knowledge. If the researchers' work is widely published, it may contribute to an extension the researchers' network, thus increasing the access to knowledge again. If some of the elements are weak or absent, it will decrease the efficiency of the research.

Figure 1 A circle of knowledge processes



The model builds on several assumptions. First it assumes that an increased access to knowledge do improve scientific production. This assumption will only be valid if the researcher has the abilities to sort out relevant information and the capacity to build new research on that. The mere presence of the Internet will not improve production as tacit skills are needed to take benefit of it. Furthermore, the model assumes that there exist research environments working on related topics that can give a contribution in the specific research to be carried out.

The model's circular form expresses a continuous dynamic process, in that way it clearly differs from a linear model. During a given research project, all elements in the model may be revisited several times.

The Internet can be part of all phases in the model. For this study we concentrate on the acquisition phase, sharing phase and networking phase. The Internet gives an opportunity to acquire information and publish research results from the World Wide Web, and to use communication facilities like email for building and strengthening a network.

The model is inspired by the authors understanding of how the most successful researchers interviewed built up their career. For example: a premium researcher has a wide network and from this she gets invitations to seminars and congresses. Through this network she also gets access to know -what and -why knowledge that she could not afford otherwise (like books bought to her and indirect access to payable academic

journals). As a result of an increased access to encoded knowledge and a strong network, the research quality improves. Consequently, her research is widely published and more people contact her and invite her to participate in their research projects.

This chapter has highlighted the importance of possessing and creating knowledge for the world's economies. ICTs in general, and the Internet in specific, play an important role in facilitating storage, organization and flow of information. Thus, to analyze and understand the interplay between the Internet use and knowledge processes give an important contribution to innovation studies. After a chapter on Research Methodology, the conceptual framework developed in this chapter is used on the case study in chapter 5.

3 RESEARCH METHODOLOGY

The theoretical point of departure for this thesis is mainly literature on knowledge both from National Innovation Systems (NIS) and Knowledge Management sources. Using theoretical concepts on how knowledge is created, acquired, shared and transferred, the role of the Internet in these processes in a university environment in the South is identified. In brief this thesis combines the phenomenon of the Internet with knowledge theory in a specific socioeconomic setting. Using concepts from the theoretical part, interviews with researchers concentrate on the linkage between the usage of the Internet and knowledge processes. Findings from previous empirical studies on academia and the Internet in a Southern context also serve as a background.

This chapter will give an outline of the logic and structure of the research work: An exploratory, qualitative multiple case study employing semi-structured interviews with a mixed sampling of the population. The data has been analyzed through a systematic comparison of the respondents' answers. The results are presented in a discussion supported by tables and figures illustrating the findings.

3.1 An explorative case study of Internet usage

Since little research has been done on Internet usage in academia in developing countries, an exploratory study will make a good entrance to get a general understanding of the phenomena, and be an important basis to build on for later studies. Sedlack and Stanley (1992) mention three factors that make exploratory studies challenging. First because there will not exist a conceptual model before the study start. In this thesis the researcher builds on the theory on knowledge creation

and transfer, and thus follows Sedlack et al's suggestion to look at different but related areas. The second point concerns the researcher's role, whether he should be anonymous or open regarding his research. Sedlack and Stanley argue that an anonymous researcher can get less biased information from the respondents, but risks not to get access to key informants. In this case, it would be impossible for the researcher to penetrate the environment anonymously. Furthermore the data gathering technique, interviews, make an open approach a natural choice. Thirdly, the data collection strategy should be exhaustive, assuring triangulation. This has been done, through interviews with different groups of respondents: IT technicians, university management and researchers (see also section 3.2 discussing the interviews) and through collection secondary data such as general information brochures and policy documents.

The theme for the investigation of this thesis is the use of a relatively new technology, the Internet, in a specific context - universities in a developing country. It aims to find out how the use of the Internet influences on researchers' work to get and share information and how it participates in creating and maintaining a network. According to Yin (1994) a case study is particularly useful when "a 'how' or 'why' question is being asked about a contemporary set of events over which the investigator has little or no control" which indeed is the case for this study.

Punch (1998 p. 153) sums up four characteristics of case studies that also apply to this work. Firstly it has boundaries; this study is limited to researchers use of the Internet in knowledge processes at three specific universities. Secondly, it is a case of something – this is a case study of the use of a specific technology in a well defined

context. Thirdly, a case study has a holistic approach. This project aims to include individual, organizational, social and economic factors that influence on the phenomenon under discussion. Lastly, as already mentioned, multiple sources of data are used.

By approaching three different universities with different characteristics, the research can be characterized as a multiple case study. The distinction between the cases is: good, limited and no Internet access. This way the research aims to, through comparison, see how the usage of the Internet depends on Internet-access, and thereby reveal distinctive patterns of the use of the Internet. Following Yin's terminology, this is a multiple experiment with contrasting results (Yin, 1994).

3.2 A qualitative study based on interviews

The reason for doing a qualitative study lies primarily in the nature of the research objective. The aim is to gain in-depth understanding of the Internet's influence on knowledge processes. As there are few empirical studies of the use of the Internet in the circumstances described in this study, a qualitative study is well suited to reveal the pattern of the use of the Internet in this context.

For this study, interviews were the most effective data-gathering method. According to Yin (1994) interviews are one of the most important sources of a case study. More specifically, following Yin's terminology, *focused* interviews were conducted. A focused interview is an interview where the "respondent is interviewed for a short period of time … likely to be following a certain set of questions" (ibid, p. 84). Through such interviews personal accounts on how the Internet is being used and the

interviewees' interpretation of the factors influencing this use were obtained. The culprits of this method are "bias, poor recall, and poor or inaccurate articulation" (ibid, p.85). To minimize those effects, secondary data has been obtained through interviews with administrators and technical staff in an attempt to triangulate information regarding the local Internet history and infrastructure.

Qualitative interviews have been well suited to get an understanding of the Internet usage of the respondents. Interviews can be highly targeted and insightful (Yin 1994). An alternative would be observation, but for this specific project it was not feasible. The time-frame available would not have been sufficient and a language barrier would filter too much information. In addition, it would have been more selective, conducting interviews enabled the researcher to cover three different universities and investigate 25 researchers within three weeks.

During the interviews, an effort was done to follow up themes introduced by the interviewees, and many times additional discussion took place before and after the formal interview. Information from those moments has also been used in the discussion of the findings.

Interviews were done individually. Group interviews can give richer information caused by the interaction within a group (Punch, 2003), but in this case a language barrier made such an approach too complicated. The interview guide used is enclosed in attachment 3. It shows how the theoretical framework has inspired the collection of information along three main axes: getting information, sharing information and creating and building a network.

Certainly the language barrier posed an extra challenge, especially in the case where interviewees did not speak English. All interviews were done in cooperation with a native research assistant with good interpreting skills. To minimize distortion in the translation processes, she was involved in the planning of the interviews, and we worked together with the transcription of the collected data. During the interviews the respondents were encouraged to use Indonesian if they had problem in expressing themselves in English. It was observed that in some cases the interviews were more personal and direct when speaking the local language, so the presence of the research assistant increased the quality of the interviews.

3.3 Sampling

As this is an exploratory study I sought to find interviewees with a diversified background. Interviewees should represent different age groups, be of both sexes, and they should come from both social and natural sciences environments. A small number of interviewees were identified in advance using of my personal network. Additionally some resource persons were identified by browsing the Internet and through email contact with them, other interviewees were found. At the universities, some interviewees were identified through a coordinator, typically head of department, and others through a targeted search for users with a specific profile. Such profiles were women, older people and non-users. By combining these methods a time-efficient selection was done. By using coordinators with authority, interviewees had to participate, and this reduced the time spent on identifying interviewees. During the interviews, it became clear that this method gave a biased

sample: the coordinators preferred to present interviewees with good Internet and English skills. This in spite of the author's insistence that speaking English was not a prerequisite, and that interviewees with a varied level of skills in the use of the Internet were required. To balance for this bias, interviewees were also identified by direct approach at the universities and by using snowball-sampling. A total of 25 researchers were interviewed, with 10 respondents from each of the major universities and five from the smaller university. These numbers were chosen to assure a sample as broad as possible taken age, gender and theoretical background into account.

3.4 Data analysis

The method used to analyze the data has been what Crabtree and Miller (in Nigel King, 1994 p. 120) call template approach. The transcripts from the interviews were subjected to an analysis in order "to group meaning of statements into subcategories" linked with the research questions. Concretely, this meant that the essences of answers to the different categories of questions were put into a spreadsheet, so that answers within one case (one university) easily could be compared. Similarly, the findings from the different cases (universities) could be compared. From this a narrative of typical respondents has been identified, and the different phases of knowledge processes have been analyzed one by one. The results have also been discussed with the research assistant, thereby adding another form of triangulation: triangulation between different researchers (Hammersley and Atkinson, 1987, p. 190).

3.5 Reliability and validity

Jensen's (1991 p. 44) explanation of *reliability* is that from the data gathering should be independent of random and, for the research, irrelevant circumstances. This kind of in-situ research, describing Internet's usefulness for researchers in producing knowledge, is far from a laboratory experiment. As this is an exploratory study, one wish to shed light on factors influencing how the individual use the Internet. Still it does not aim to be exhaustive in its description of every influencing factor. The economy of the universities, the recruitment base of researchers, individual initiatives and the local culture are all examples of such factors. However, the complexity of what is influencing and how this is influencing is too high, and the nature of this study will not make it possible to reveal all such influences. Yin (1994 p. 33) cites Kidder and Judd who explain reliability this way: "demonstrating that the operations of a study- such as the data collection procedures can be repeated, with the same results". An example of an effort to ensure reliability is the use of an interview guide. Nevertheless, the dynamic of the interviews was influenced by time limits, the personal connection, moods etc, and it would be naïve to believe that this does not influence the results obtained. Still, with the relatively high number of respondents, I feel confident that the main conclusions would be the same if the case-study was to be done again.

Yin (1994) dissects the question of *validity* into several parts, two of which are relevant for this study: Constructed, internal and external validity. The constructed validity can, according to Yin, be increased by the use of multiple sources and by showing "a chain of evidence" (ibid p. 33). The main sources in this study are interviews with 25 researchers and also with staff from university administration and

technical support staff. Additional sources could have been observation, digital evidence in the form of bookmarks and history from web-browsers, email archives and more. Both for practical and ethical reasons those methods have not been used. Still, interviews with different groups assure, as mentioned, a triangulation and improve the validity. A "chain of evidence" is also assured in the way that all interviews are available on tape and transcripts, and extracts from the transcripts are presented in this thesis. Internal validity, according to Yin, deals with whether *x* really leads to *y*, or if there is an unknown factor *z* that is involved. This is indeed relevant for this study, because there is an assumption of a relation between the use of the Internet and the quality of a researcher's work. Still, as Yin also argues, for exploratory studies as this one, it is too early to make any causal statements, and the question of internal validity is therefore not further pursued. Finally external validity is "the problem of knowing whether a study's findings are generalizable beyond the immediate case study" (ibid, p. 35). The results from this study are not meant to be generalized. As Sedlack and Stanley (1992 p. 302) argue, "data evolving from exploratory efforts are, by definition tentative" and therefore not representative. They will rather highlight aspects regarding the use of the Internet within a research context in the South that one should be aware of when planning ICT policy both from a national and also development agency perspective. From the results found hypotheses that sum up valuable findings might be formulated, which in turn can direct new qualitative and quantitative follow-up studies. A replication of the findings from this thesis in other case studies will increase the external validity of this case.

4 KNOWLEDGE AND EDUCATION IN A NORTH–SOUTH CONTEXT

4.1 Introduction

This chapter provides an overview of the empirical context for the case study. After a general introduction it presents a review of literature concerning the development of higher education with a special focus on the implications for developing countries. The last part presents a few empirical studies that have focused on the use of the Internet in universities and the development of Open Access resources.

Modern societies rely heavily on its learning institutions from primary and secondary schools, vocational schools to universities. For countries struggling with a weak economy and/or unstable political systems, it is challenging to maintain an efficient educational system. According to UNESCO (2005 p.97) the challenges when it comes to education in developing countries are

> "the obsolescence of existing infrastructures, the decline of the quality of higher education, the underdevelopment of research infrastructures, the 'brain drain' towards the wealthy countries, the digital divide, the linguistic and cultural barriers, the reduction of state funding and, in certain cases, the lack of genuine public policies in this field."

The challenges are thus complex and involve economics, politics, and socio-cultural factors. In the literature the challenges are often described as *divides* between North and South that have to be bridged.

For the context of this thesis the divides to be addressed are those related to ICTs, also called *digital divides*. UNESCO (2005) lists several types of digital divides: In addition to the before mentioned economic and educational digital divide, digital divide can also exist between geographical regions, different age-groups, between

gender, between holders of different languages, between unemployed and employed. These divides can exist in every society; they are not only third world phenomena. Parayil (2005) also points out that a digital divide is more than a problem of connectivity, a pure technological problem. He argues that the digital divide is one of several symptoms of fundamental differences between knowledge economies and traditional economies[11]. A major difference, explains Parayil, is that while traditional economies have decreasing returns, knowledge economies have increasing returns[12]. This results in an income gap between and within countries that enhances disparity in general and leads to a digital divide.

An increasing focus on lifelong learning in western economies reflects the necessity to continuously adapt to new technology and changing economic realities. Arocena and Sutz (2003) argue that divergence between developed and developing countries are more and more related to a *learning divide*: While a significant part of the population in developed countries upgrade their technological capabilities[13] and their scientific knowledge continuously in a *learning society*, this is not happening at the same scale in developing countries. Therefore, when National Innovation Systems (NIS) theory is discussed as a tool for development, the learning divide is given special attention:

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[11] Parayil defines a traditional economy as an economy depending on "primary, bulk processing and manufacturing industries", whereas the knowledge economy depends on "knowledge workers, investors, and entrepreneurs as well as others involved in consumption and service sectors".
[12] Increasing returns means that the profit for *one more* produced product increases because of low production cost compared to the investment research and development expenditures.
[13] *Technological capabilities* are understood here as the ability to assimilate, use and further develop new technology.

> Knowledge may indeed be viewed as a central resource and development factor, but what matters most may be the capability to produce, spread and utilize it. The learning divide, more than the technology divide, may, thus, be the crucial factor in the North/South relationship, which development policies have to take into account. … What we primarily refer to here, however, is the infrastructural, institutional and organizational underpinnings of learning.
>
> (Johnson et al, 2003 p.10)

In the following case study, several aspects of what Johnson, Edquist and Lundvall (2003) here describe are central.

As the previous paragraphs show, a developing country may suffer from a learning divide and digital divides that are caused by a combination of factors such as: unfavorable policies, social and cultural context and characteristics of the economy. Regardless of the explanation of the divides, it remains important to understand how knowledge acquisition and sharing, and networking are actually taking place, and the role that Internet is playing in these processes. By identifying strengths and weaknesses in those processes, an improved learning society can be built for the future.

4.2 Higher Education in the South

When analyzing knowledge creation and transfer in academia, it can be useful to have a global view of the interrelationships between universities throughout the world. Altbach (2005) has written an essay on how the ongoing globalization has an impact on higher education, and he describes what might look like a hierarchic structure of knowledge creation. He observes a split between universities in the center and in the periphery. The *central universities* situated in the richest countries are privileged in several ways. They have a significant amount of resources that allows them to invest in expensive laboratories, advanced information and communications technology and attract the best researchers. They exist in a society that has legislation and traditions

that support academic freedom. In contrast *peripheral universities* depend on both research and training from the central ones, and function mainly as teaching institutions. A third category, *regional centers*, provide a link between elite and periphery institutions. Typically regional centers are well known universities that have close links to researchers at the central universities.

It makes sense that the most resource-demanding research is concentrated to *central universities*. However, in order to conserve and exploit local knowledge, research has to take place also in periphery institutions. Also, as shown by Cohen and Levinthal (1990) doing research improves the absorptive capacity, and research at a local level might be imperative to make knowledge transfer from leading universities possible.

In the book 'Knowledge societies' UNESCO (2005) describes the importance of networks between universities and exchange of both staff and students. When knowledge becomes more and more specialized, networks of universities can be organized so that each university specializes according to local needs and strengths.[14] An interesting possibility for developing countries, aside from building networks by their own, lies in hooking into international networks now taking shape between universities (UNESCO, 2005).

[14] This is the way the network initiative 'European Studies of Science and Technology' (ESST) is built up. In theory, one university can specialize on one aspect of Science, Technology and Society studies, but still offer students a broad specter of options through exchange agreements with other universities in the network. A disadvantage is that travel (and possibly lodging) expenses increase for students and/or lecturers. Also it implies an increased workload in administration and on standardization efforts. On the other hand, significant resources can be saved both on capacity building among lecturers, and on laboratories and other specialized equipment and structures.

Both Altbach's article and UNESCO's book "Knowledge societies" emphasize the importance of linking universities together. The Internet can be one instrument to this end. In the next section previous studies of the use of the Internet in academia and in research organizations, and a study on electronic journals and databases will be presented.

4.3 Empirical studies on ICTs use among researchers in the South

Dong (2003) has conducted a quantitative study about Internet use among 700 students and academics in two cities in China. The research objective was to examine the use of Internet resources and find the users view on Internet's usefulness. The study showed that both the use in hours and the experience of usefulness increased with the educational level of the user.[15] The use of a search engine was found to be the most important channel for obtaining information for four out of five users. The study also showed that users from the social sciences used the Internet more than those from natural sciences. Most users had acquired Internet skills through learning by doing and through personal contacts. Main barriers to the use of Internet was said to be in decreasing order of importance: slow speed, cost, poor information quality and difficulty to find relevant information.

[15] The result from Dong's study that experience of usefulness seems to increase with educational level is worth to notice. Is it so that in order to navigate in the ocean of information available through the Internet, the user needs a certain level of education to be able to extract valuable information? Or can such skills be learnt independently of educational level?

Okunoye and Karsten (2003) investigate the use of the Internet in six African research organizations South of Sahara. They conclude that "the current phase of ICT exploitation appears to be about experimentation, limited use and uneven coverage in most institutes" but even so they point to examples where the Internet do make a difference for the researchers.

In a study King (in Chan and Costa, 2005) found that researchers in eight countries produce almost 85 per cent of the world's most cited publications, whereas 165 other countries (mostly developing ones) produce less than 2.5 %. This is confirming Altbach's (2005) division between central and periphery universities. Researchers in developing countries have limited access to research literature published in the North (Chan and Costa, 2005), but the situation is getting better and Chan and Costa give an informative description of developing countries' improving access to information through electronic journals and databases.

4.3.1 The emergence of free databases

For years many journals have been offered to reduced–rates to libraries or subscribers from developing countries. A newer trend is that journals in electronic format are being offered through national licensing and other broader initiatives, and this way a collection of journals are offered in a package. An example is the 'Health Inter Network Access to Research Initiative' (HINARI) launched by the World Health Organization in 2002. More than 2000 journals from the most prestigious publishers are accessible. Institutions in the poorest countries are given free access. There are several similar programs, both for specific topics (Food and Agriculture Organization's AGORA which focus on agricultural research) and general ones (e.g.

Soros' Foundation 'Electronic Information for Libraries.net'). Chan and Costa (2005) list several drawbacks with such initiatives, one is the question of *validity:* Certainly important information will be spread through such databases, nevertheless a danger lies in offering knowledge of little or no use. The South is different from the North, resources and problem areas differ dramatically. In many cases local knowledge or information produced in a developing country context would be more adequate. Smaller, specialized journals focusing on the South that are not included in the publishers' package-offers, may suffer when libraries resources are tied up to package-subscriptions. Another issue is the problem of *sustainability:* Most publishers do not allow customers to make local back-up archives and when subscription comes to an end, no printed material will be available. In contrast, money spent on books and printed journals will enhance the library.

The concept of 'Open Access' journals and archives challenge the traditional publishing world with its free availability online. The 'Directory of Open Access Journals'[16] contains more than 2000 journals, and Cern Document Server[17] contains more than 360 000 documents. There are several initiatives aiming to increase importance of Open Access Journals.[18] For developing countries Open Access content is promising not only because it provides immediate and free access, but also due to its potential in publishing knowledge produced in the South that so far has had limited diffusion. An increased diffusion of Southern research can happen because the cost of

[16] Directory of Open Access Journal home page: http://www.doaj.org/home
[17] Cern Document server homepage: http://cdsweb.cern.ch/
[18] In November 2005, Lund University recommended its staff to publish work in journals that are free for the public, as far as it is possible (NN, 2006).

publishing is lower, and therefore specialized databases for research related to a Southern context can be built up with lower costs.

4.4 Concluding remarks

This chapter shows that building of networks between institutions of higher education takes place in various forms. Universities are linked together through exchange of academic staff and students. Regional centers supply research from prestige universities to local universities. Digital knowledge bases show a great potential for sharing research output. Globalization in higher education is taking place, and actors not taking part in international networks risk falling behind.

5 CASE STUDY

In this chapter the results from the case study are presented and discussed. After a brief description of the universities under investigation, the empirical findings[19] follow. In section 5.2 to 5.4 the use of the Internet for knowledge acquisition, knowledge sharing and networking is treated. In section 5.5 the obstacles for efficient use of the Internet are discussed. Thereafter the factors influencing on a researcher's use of the Internet, are presented in section 5.6.

5.1 The universities

Three universities of different profile and status were identified in order to investigate the use of the Internet in various settings. The first university chosen was University of Indonesia in Jakarta. In an Indonesian context it represents *a regional center* (see section 4.2) as it have extensive cooperation with American, European and Japanese universities. The two other universities that were identified in Banda Aceh were Syiah Kuala University and the State Institute of Islamic Studies. They can be characterized as *peripheral universities* that depend on regional centers like the University of Indonesia, especially for education and training of their academic staff. Common for the three universities, is that all lecturers are encouraged to do research.[20] Career advancement requires publishing in recognized national or international journals.

[19] The empirical data were gathered during a three weeks field visit to Jakarta and Banda Aceh in July 2006. The interviews were conducted either in English or Bahasa Indonesia (the official Indonesian language) with assistance of a translator. A total of 25 lecturers and five administrative staff members of three different universities were interviewed.

[20] The Indonesian law in Article 24 Law No 23/2003 on the National Education System, obliges higher education institutions in Indonesia to engage in 1) Education and teaching, 2) Research and 3) Community service.

This study compares the use of the Internet at three universities with important differences in their ICT infrastructure. They also differ in size, economy, academic fields and in geographical and cultural setting. As a result an enriched variety of data is obtained, giving a broad basis for the exploratory study. Later on, carefully designed studies can go into depth in the topics here presented.

5.1.1 Universitas Indonesia (University of Indonesia)

The University of Indonesia is Indonesia's most prestigious university. It is an autonomous state university, and gets funding from both government and private sources. With twelve faculties and currently around 38 000 students, it is also the largest university in Indonesia.[21]

The University of Indonesia aims to be "a research university" by 2010, this implies that they have ambitions to increase focus on research in the coming years.[22] According to a survey done in 2004, about 35 percent of the lecturers where classified as active researchers (respondent UINS4).[23]

Despite its status as a principal university of Indonesia, the ICT infrastructure still lags far behind many universities in the North. With a total bandwidth of 25 megabits

[21] Data from Biro Administrasi Kemahasiswaan (Student Administrative Bureau), University of Indonesia, July 2006)
[22] From the official homepage, the goal of the university is to "preserve UI reputation as the best university in Indonesia by producing qualified graduates, who are able to compete in the global market and produce qualified research" (The UI homepage, www.ui.edu accessed on 10.09.06)
[23] To secure the anonymity of the interviewees, they are coded as explained in attachment 1.

per second to connect the university to the Internet, the actual transfer rate for each user will most of the time be well below 100 kilobits per second. Typically an article of 500 kilobytes will take a minute to download. (informant A[24])

5.1.2 Higher education in Aceh province

There are a number of universities in Banda Aceh, but the most well-known are located in a campus area in Darussalam about 15 km outside the city center of Banda Aceh. The main universities are Syiah Kuala University and the Ar-Raniry State Institute of Islamic Studies. Both are named after famous *ulama's* (religious leaders) known for their dedication to education. Syiah Kuala was founded in 1961, and Ar-Raniry in 1963 after the separation of Aceh province from North Sumatra province in the fifties. (Daoud, 2000)

5.1.3 Syiah Kuala University

Syiah Kuala University is the leading university in Aceh province. It has eight faculties: Teacher's Training and Education Faculty, Faculty of Economics, Faculty of Law, Faculty of Veterinary Science, Faculty of Agriculture, Faculty of Medicine, Faculty of Engineering, and Faculty of Mathematics and Natural Sciences. About 1400 lecturers give classes and supervise about 24000 students.[25]

Syiah Kuala University got its own website for the first time in 1996 when an Internet service provider was established at the provincial post office in Banda Aceh (Daoud,

[24] See attachment 2 for a list of informants for secondary data. A is the initial of the informant who, as many Indonesians, only have one name.
[25] Official brochure: "Data and Information Universitas Syiah Kuala" 2005

2000). However it was not before 2002 a local area network that included all the faculties was established, thus giving the academic staff in general access to the Internet (informant FJ).

Compared to the University of Indonesia, the Internet facilities are less developed at Syiah Kuala University. The bandwidth connecting the university to the Internet is 1 Mbit/sec, but this bandwidth is also shared with two other organizations (FJ). In addition, two faculties have special agreements with NGO's and UN agencies leasing additional bandwidth of 512 kbit/sec to 1 Mbit/sec.[26] For a total of more than 400 computers, this still gives very limited bandwidth for each user.

5.1.4 State Institute of Islamic Studies (IAIN)

IAIN stands for *Institut Agama Islam Negeri* which translates as State Institute of Islamic Studies.[27] About 250 lecturers are teaching around 5000 students at five faculties: *Tarbiyah* (Islamic law), *Ushuluddin* (Islamic morality), *Dakwah* (Islamic Communication) and *Syari'ah* (Islamic law) and Language and Islamic Literature.

Until July 2006, IAIN has no Internet connection, nor does it have computers for neither students nor lecturers.

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[26] After the tsunami disaster 26th of December 2004, several volunteers founded an ICT Emergency Response Team and established Aceh IT Media Center in Syiah Kuala University, supported by various UN agencies. Later on, most of the equipment and facilities were handed over to the university. Source: http://acehmediacenter.or.id (accessed on 10.09.06)

[27] There are several types of higher education institutions in Indonesia, among those are universities recognized by the Ministry of National Education and Islamic Institutes that come under the Ministry of Religion Affairs. (World Higher Education Database, available from www.unseco/iau/index.html) There are 14 State Institutes of Islamic Studies in Indonesia.

5.2 Knowledge Acquisition

The first sections (5.2.1-5.2.4) in this subchapter assess the different sources researchers have for codified knowledge and address the languages used in this context. Thereafter a discussion on access of know-what, -why, -how, -where and -when is presented in section 5.2.5 and 5.2.6. Section 5.2.7 discusses obstacles faced when using the Internet for gathering of information.

5.2.1 Getting information from the Internet

Despite the limited Internet bandwidth available (compared to western standards) at University of Indonesia, many of its researchers are highly reliant on the Internet. They use the Internet on a daily basis for both emailing and web browsing. The most important source of information for research purposes is payable electronic journals (89 % of the respondents at the University of Indonesia). If the article the researcher looks for is in a journal that the university does not subscribe to, she/he will often get it sent from a former supervisor or a colleague at a university overseas (44 % of the respondents from UI informs about this without being asked specifically).

The findings from Syiah Kuala University show a similar pattern, but far fewer respondents obtain articles from payable electronic journals (about 40%). As the university does not subscribe to any e-journals, it is surprising that so many still manage to make use of those resources. This is possible because the researchers have a network overseas that can assist in downloading and forwarding articles (in the same way as it is done at University of Indonesia). This phenomenon is well known among the university management. In an interview, Syiah Kuala University Rector Darni Daoud says that:

> …individual exchange of information is very important, especially [for] those that graduate from foreign universities. When they come here they have still contact with their professors there and they can access the information [indirectly from pay-sites]. With the Internet everything is open and traditional barriers are broken, and making us more globalized in looking at the world. [28](DD)

Hence, the practice of getting payable information through contacts overseas is well known. As the university encourages the younger staff to pursue further education abroad those initiatives can be partly seen as a strategy to gain access to information. At the same time, it is difficult to take full benefit of this kind of information transfer. For example, one could imagine building a common electronic database with articles sent by mail from overseas, but copyright protections makes this difficult. The management has to have a pragmatic approach:

> We have a policy here that everything should be legal, copyright should be respected. But exchange of information, we can not stop it, and I think it is acceptable in academia. (DD)

There exists an intellectual property rights regime that forces developing countries to break copyright laws in their quest for knowledge. A pricing of codified knowledge that is unattainable for developing countries implies that copyright laws will not be followed.[29]

The main sources of information for both research and teaching at IAIN are, according to the respondents, journals and books. Even if there are a number of

[28] The access for codified knowledge has been a problem particularly present in Aceh. Rector Darni Daoud at Syiah Kuala University comments : "For us here one of the difficult problems we have here is lack of information, geographically we are isolated, politically we are in a very difficult situation most of the time … information that many people can access in different parts of the world … may not take place here."

[29] A similar discussion is presented in Ernst and Lundvall (1997) regarding international production networks: "The main remaining institutional problem (…) would be to establish appropriately balanced intellectual property right regimes which on the one hand stimulate the creation of new technology and which, on the other hand, do not restrict the diffusion of new knowledge to late industrializing countries."

warnets[30] around the campus area, none of the respondents use them regularly for collecting information for their research. The use of the Internet among the respondents is sporadic, and the sources used are arbitrarily chosen from Google and Yahoo searches. The main use of the Internet is for general news and material to support teaching. None of the respondents have accessed payable academic journals, nor are they aware of open access initiatives.

5.2.2 Getting information from the library

It seems that the presence of the Internet makes researchers less likely to use the library, 56 % of the respondents at the University of Indonesia say they never or rarely use the library. "I don't have to go anywhere, I can do it from here" says respondent UINS1.[31] Until 2005, the main library had about 70 titles of academic journals available as hard copies. Today only e-journals are accessible. Each faculty negotiates with the publishing houses for journals of their interest, and later the main library makes the online journal available for the whole university through the Internet and intranet (interview with M). At Syiah Kuala University the researchers complain about the quality of the library, saying it is not updated, having few books and journals. About 50% says they rarely use the library. The university library at IAIN was flooded in the 2004 tsunami, and the paper-catalogue was destroyed.[32] Some respondents at IAIN say they depend on personal books and the public library for their research.

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[30] Abbreviation of Warung Internet, the Indonesian word for an Internet-café.
[31] Statistical data show a small decrease (less than 10%) in the use of the main library among academic staff since 2003 (M)
[32] The post-graduate library is more updated, and it is computer indexed. It has few books but a wide selection of journals. It does not subscribe to journals, but benefits from private donations.

It is illustrating that in the universities in Aceh, the quality of the libraries is low *and* the access to premium cites on the Internet is difficult. The Internet does connect Aceh universities to the world, but still access to the finest codified knowledge is restricted. Can Open Access Archives be a solution?

5.2.3 Use of open access sources

Although 40 % of the respondents at the University of Indonesia have heard about Open Access initiatives, only one respondent reports that he uses an Open Access Archive regularly. At Syiah Kuala University half of the respondents are aware of Open Access initiatives, but only 10% actually use those resources. None of the respondents from IAIN had any knowledge about Open Access sites.

Interestingly, it was the same Open Access archive that was being used by the respondents at University of Indonesia and Syiah Kuala University: the physics archive of Los Alamos. According to respondent UINS3, the world's leading researchers in the field publish their results here. He explained that previously he used it to get feedback on his drafts in order to improve the quality of his articles. Now that his name is better known, he prefers to first get it into a scientific journal and then publish it at the open archive. This way he reduces the risk to put any erroneous calculations in the open archive. This archive has somehow gained a special reputation, and manages to attract the best researchers to publish there. This contrasts the claims from researchers not using Open Archives because they feel they lack quality and actuality. It also highlights that a solution that work well in for one group of researchers, may not succeed for others. The interviews with physicians suggest

that the fact that well known physicians choose to publish in the Open Access archive, increases its popularity. Also the attitude shown from interviewees showing willingness to compromise on copyright obligations with academic journals may differ between different research environments. The existence of Open Access solutions in itself does not guarantee its adoption by researchers. Nevertheless high quality Open Access archives is the only alternative identified as a sustainable solution for universities with very limited financial resources.

5.2.4 What languages are used?

English is the main language used for information retrieval at the Internet for all the respondents at University of Indonesia. Possibly because the interviewees all were familiar with English after studying abroad, it was only mentioned as an obstacle by two respondents (20%). At Syiah Kuala University 60% of the users answer that they mainly use English for information retrieval. The interviewees reveal that it is more difficult to find information in their field in Indonesian, that the quality is higher and even that “it is more comfortable in English” (respondent SKNS3). These numbers are surprising, but they reflect two facts: English is the dominant language for presenting research results at the Internet and, as we shall se later, very few Indonesian researchers publish at the Internet, and if they do, mostly they do it in English.

5.2.5 Access to know –what –why and -how knowledge

Following the definition in chapter 2 “know-what” knowledge is understood as an awareness of relevant and updated facts within the researcher’s field of interest. The Internet is widely used to access codified know-what knowledge for research purposes, and Internet sources varies from academic online journals, university sites and NGO sites to personal sites. The empirical evidence show that the way of

searching information varies from simple use of generic search engines, to targeted use of specialized open access archives.

We have seen that the most advanced Internet users are able to keep updated with the latest development in their field thanks to access to online journals, be it payable or open access ones. Respondent SKNS4 answers this when asked about the kind of information he is searching for on the Internet:

> I have to know how far this research has come in Indonesia. If you need to compete for the research grants, you need to know also the position of the research in Indonesia. If I want to publish internationally, I have to read international articles…

The researcher emphasizes his need for updated information. The Internet is probably the only available source for some of the information he is looking for and therefore of high value for this researcher.

Know-why knowledge is typically a theoretical description of a phenomena or a model. An example of traditional ways to learn such knowledge would be through lectures and books. This kind of knowledge can be transferred through the Internet provided that the receiver has the necessary basis to build on. An implication of this is that the stronger fundament the receiver have, the more know why-knowledge he can achieve through the Internet. An example of transfer of this kind of knowledge can be found in the following statement from UINS2:

> What I need is the latest research, the current one. I look for really comprehensive theses. Articles in journals are not so detailed.

This statement, in addition to inform us that he search for *updated* "know-what" info, also indicate that he seeks information that improves his understanding. To this end he

depends on in-dept information which he has experienced that he can find in selected theses.

Examining if know-how knowledge can be transferred through the Internet is more complicated, as know-how knowledge is more tacit in nature, and therefore less likely to be transferred this way. Still one can imagine transfer of know-how knowledge through the Internet if the information is highly detailed, and especially in the case of interactivity between the sender and receiver, which indeed often takes place. Says respondent SKNS4:

> After I get an article I may have discussion with the author … We can ask about methodology, and the meaning of this and that.

5.2.6 To know where and when…

Information about congresses and seminars is said to be found on the Internet by one third of the respondents. However, when asked specifically, most of the time they have first learnt about the event through advertisements, friends or through a direct invitation. Later they search for additional information of the event on the Internet. So the Internet is, in this case, partly a source for *know when and where* knowledge. Even if, theoretically, this knowledge could have come only from the Internet, this knowledge is attained only through a combination of social contacts and the Internet.

5.2.7 Obstacles faced when using the Internet for info gathering

When it comes to obstacles for gathering of information through the Internet, most respondents describe technical problems as the main problem.[33] Two respondents mention the amount of information as an obstacle.

> Personally I am not able to control myself, searching and exploring, and then usually when I start to find something, it is outside the core, that's killing me, sometimes you do not remember even the time. (UISS1)

At Syiah Kuala University, 40% of the respondents feel that pay-sites are an obstacle to get information. At IAIN the respondents list limited time for research, lack of computer skills and limited access to the Internet as obstacles.

When asked about how they learnt to search for info at the Internet the interviewees reveal that they have learned by themselves or through friends or colleagues. The lack of formal training in information seeking on the web cause many researchers to have a suboptimal technique for information seeking. Too much depends on the researchers own initiative, interest and his/her environment. It reminds us that connectivity in itself does not assure efficient use of the Internet, training and other incentives are necessary to improve the quality of Internet use.

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[33] Technical problems are hindering all kinds of Internet activity, but it was often mentioned as an obstacle also for information gathering. Especially the speed of the Internet connection is frequently complained about. Some respondents also mention virus attacks as a problem, especially at Syiah Kuala University. It is more difficult to have updated anti-virus software when the Internet-connection is limited and unstable. Another problem is power instability and blackouts. This not only limits the use of the Internet, but also damage equipment. These examples of technical obstacles highlight the fact that the use of technology in less developed areas often demands more resources, both technically and economically compared to developed regions. Technology innovated in a rich country, may not meet the specifications poorer countries needs.

To sum up the findings about the Internet used for knowledge acquisition table 2 shows some of the key numbers. Due to the small sample, the numbers are not necessarily representative, but give an indication on how information for research is gathered in the specific cases of this study.

	University of Indonesia n=7-9	Syiah Kuala n= 8-10	IAIN n=5
Knowledge acquisition			
Uses web to get info from payable academic journals	89 %	40 %	0 %
Aware of open access initiatives	40 %	40 %	0 %
Use open access sources	11 %	10 %	0 %
Use file sharing (for e-books)	0 %	10 %	0 %
Frequent library user	44 %	50 %	60 %
Know-when and -where info from the Internet	50 %	20 %	0 %

Table 2 The Internet used for knowledge acquisition[34]

5.3 Knowledge sharing

In this section the findings regarding how knowledge in the form of research articles is shared with a focus on the use of the Internet for this purpose. After identifying the media used for knowledge sharing, the obstacles for using the Internet for web-publishing will be discussed.

5.3.1 What are the main channels for publishing?

The main channel for publishing at University of Indonesia is printed journals (reported by 89 % of the respondents). About 50 % have published in international

[34] Judging from the presented data, the Internet seems to be well integrated in researchers' work at the University of Indonesia, but we must be aware of a possible bias of the sample of respondents (see discussion in chapter 3). Several respondents indicate that there are researchers who are not familiar with the Internet: Says respondent UISS1: "Some of my colleagues do not even know that we have Internet facilities. Mostly the old lecturers, some even using traditional typewriters." UINS1 speculates: "Old people do not use Internet a lot probably because of eye irritation."

journals. Faculty journals, departments' journals and national academic associations' journals are also important media for sharing research results.

Web-publishing is done on own initiative by 25% of the respondents. In many cases researchers' work become available on the Internet indirectly through journals' web versions or electronic archives. Similarly, contributions to seminars and congresses are made available on the web by the organizers. Students making homepages containing their lecturers' articles and presentations also make research available on the Internet. Among the UI's respondents 63% have had articles published on web by others (journals, students, associations).

In one case the department has recently taken initiative to create blogs[35] for all its researchers.

> Some colleagues have published on their blogs, because it is very convenient, getting comments and having an interactive dialogue with students or other philosophers. I think it will be flourishing (UISS3)

One advantage of blogs is that they are easy to create and maintain, thereby overcoming the technical barrier hindering web-publishing now. This may encourage more researchers to publish on the web. A disadvantage of blogs is that they are not part of a scientific network with a dedicated search service. This implies that searching blogs must be done with ordinary search engines and the information might therefore be difficult to find for other researchers.

[35] Web service where the user can have a diary and readers can post their comments. A user-friendly interface make web publishing this way available for users with a minimum of computer skills.

The main channel for sharing research results at Syiah Kuala University is through local journals (60%), other national journals (20%) and international journals (30%). Only one respondent (10%) has published something on web, while 30% have had their articles published on web indirectly through a journal or congress etc.

At IAIN most respondents regard their students and fellow lecturers as their target group for their research. The dominant way of publishing is the faculty journals. None of the respondents have published anything on the Internet.

5.3.2 What are the obstacles for sharing info on the web?

Of the different Internet operations concerned in this work, publishing is the most complicated technically. Few respondents inform that they have the necessary knowledge to make homepages. Time limitations and priority are mentioned as the obstacles for web-publishing, but these explanations hide the underlying causes. Some respondents openly explain that they do not know how publish on the web. Other respondents, mainly from natural sciences, feel ashamed that they do not know how to do it and do not admit it easily. At the same time there is little encouragement from management level to publish on the web and no training to this end offered. Indeed there is even a form of discouragement as journals have to be published as paper copies; web journals will not give accreditation in the university ranking system:

> "We have put our journal in open archive as well. … Since 2000 or 2002, we put it online and have no hard copy. It brings difficulty in the accreditation because they (the authority on accreditation matters) were asking for the hard copy. (UINS3)

Several respondents are also worried about the quality of their research; they do not feel it is sufficiently high to be published on the Internet. Probably a feeling of being

exposed to the whole world restrains some researchers from publishing on the web. This is the case for respondent SKNS1:

> I did not share on Internet yet. So far I prefer to publish in journals. I do not have much time to put on Internet. If we put in Internet we should make it good, good English, we would use much time. Better to put in journal. Not good if you put to Internet, if other people read it, if it is not yet complete. Better to publish with a good publisher. I have planned to make a book through a publisher, but no time yet.

He is not the only respondent that automatically imagines that she/he has to publish in English. Another respondent says:

> How to translate to English. When we want to publish on Internet we should publish in English, isn't it? … Papers which are written in Bahasa Indonesia have to be translated to English first, while my English ability is limited, I am only able to use passive English… (IAIN1)

This misconception is unfortunate as it makes it less likely that research will be web-published in a national language.

This research reveals that the research articles in Indonesian language on the Internet are scarce. *Regional centers* like the University of Indonesia have a special responsibility to relay international research in a language accessible for a majority of Indonesian researchers and students. It seems that a systematic approach is needed in order to get more research articles published on the web, especially in the national language.

One reason for publishing on the web lies in the researchers' need to be visible in the outside world. By contributing with his/her knowledge, the probability to establish new contacts and develop co-operations increases. As it is now web-publishing seems to happen seldom, and only thanks to a second part such as journals or associations. Researchers seldom take benefit of Open Access initiatives for sharing their work.

The invention of personal blogs which simplifies the web publishing process might increase researchers' visibility on the net.

Table 3 summarizes the findings of the use of the Internet for knowledge sharing.

	University of Indonesia n=7-9	Syiah Kuala n= 8-10	IAIN n=5
Knowledge sharing			
Have published in foreign/international journals	50 %	30 %	0 %
Publish on web on own initiative	25 %	10 %	0 %
Articles/work published on web by others	63 %	30 %	0 %

Table 3 The Internet used for knowledge sharing

5.4 ICTs and networking

The increasing specialization that characterizes the knowledge society makes it even more important to know who knows what (and who knows how to do what). Through email, mailing lists and newsgroups the Internet is an important instrument for establishing and maintaining a network of researchers. After identifying the main collaboration partners this subchapter will examine the role Internet services plays for networking.

At the University of Indonesia 67 % of the interviewed researchers had studied abroad and they do keep in touch with their colleagues from that time. In fact their main research partner typically remains their supervisor from PhD studies. Also at Syiah Kuala, where 60% of the respondents have studied abroad, a continuation of collaboration with a former supervisor are the most common form of international cooperation (as indicated by 40% of the respondents). Other cooperation partners include colleagues in the same university, NGO's, UN agencies, governmental organizations and local businesses.

5.4.1 The role of email

Email is extensively used at the University of Indonesia. Says respondent UISS1: "[my work is] impossible without email" and respondent UINS3 claims that "99 % of the communication goes through Internet". Where international cooperation happens, the use of the Internet for communication purposes is extensive. With the absence of the Internet, the alternatives would have been telephone, fax and mail services. Taken into account the high cost of international calls and slowness of mail services, it is not

likely that such cooperation would have taken place to the same extent with an absence of the Internet.

For communication within Indonesia there are many obstacles when using email. Several respondents claim that they feel better doing face-to-face meetings instead of writing emails, partly justifying this by mentioning ”the oral culture of Indonesia” (UISS1). Further on the habit of checking email which varies greatly. “It is useless to contact national colleagues using email” says respondent UINS1, explaining that most researchers check the mail so irregularly that it is better to use telephone or fax. This is especially true for older people according to respondent UINS4. At Syiah Kuala University email is used by 70% of the respondents, but also here several respondents mention that email is less effective than face to face meeting. Mail, telephone or SMS communication is preferred within Aceh. Says respondent SKSS1: “the habit to send email is very very poor [in Aceh]" and respondent SKNS5 says “Not all open email every day, that is the problem.”

At the time of the study, the University of Syiah Kuala did not have a mail server. Researchers are therefore using online services like Google or Yahoo mail. Several respondents mentioned the inconvenience of this, especially when sending mail, as the draft of an email may disappear because of user errors or technical problems like broken Internet link or blackouts.

Another factor influencing the choice of the communication means is economy: email is chosen to communicate with Jakarta because it is cheaper (SKSS2), and in many cases SMS is chosen over mobile phone, also to save money (SKNS5).

At the University of Indonesia 86 % of the researchers interviewed have communicated about professional matters with strangers using email, and 38 % have established long lasting cooperation this way. “That is the way I started” claims UISS3 – he has now an extensive network in United States, Europe and Asia. Several respondents inform that they often contact authors of payable articles in order to get an article for free, and this seems to work well (half of the time according to UISS1). Also contact is made with authors in order to clarify something in his/her article. At Syiah Kuala University one third of the respondents say that they have taken contact with strangers through the Internet for research purposes, while 22% says they have been contacted.

5.4.2 Mailing lists

Although 100 % of the respondents at the University of Indonesia participate in mailing lists, most of them complain about the usefulness of those: “They are not scientific enough”, “often gossip, too much” “taking too much time”. Still for one researcher, it is the most important way to keep in contact with fellow researchers all over the world.

Most of the respondents (80%) at Syiah Kuala University participate in one or more mailing lists. Dedicated Yahoo groups are set up for several of the university’s faculties, and also a group exists for employees studying abroad. During the interviews those mailing lists are frequently referred to, and the impression is given

that they are a very important source for information about projects, funding, and vacancies and that they also are used for discussing professional matters.

5.4.3 Results from IAIN

At IAIN the academic staff interviewed work mostly independently or with colleagues from the same faculty. Some respondents have also worked with local organizations and organizations from major Indonesia cities. Even though 80% have experience with email, none of them use email for research communication. One respondent has previously participated in a mailing list. The respondents have not contacted nor been contacted by strangers for research purposes by email. The main obstacle for use of Internet for communication purposes is said to be the lack of convenient access to computers with Internet connection.

5.4.4 Is the Internet a meeting place?

Only a couple of respondents (13%) have established contacts with others exclusively through the Internet. This shows that *know-who* knowledge is acquired through the Internet among the respondents, however it is rare. Another 13% have followed up a first contact on a seminar or congress with later email correspondence. Once contact is established through a real meeting, the Internet facilitates for maintaining this relation, a relation that might not have continued in the absence of the Internet. Again this supports Lundvall's (2006) argument that ICTs must be seen as a superstructure that builds upon a basis of social relationships. A combination of social contact *and* the use of the Internet builds know-who knowledge.

The respondents that had most extensive network online, were also the most academically productive and respected ones. What is cause and what is effect here is

undistinguishable, but it is not surprising that academics that have something to offer, also more easily establish contacts through the Internet. One example is respondent UINS3:

> I met several people [through Internet]. Mostly it started because of their interest in my job and then they asked me to calculate a formula etc, and I sent it back to them. At the end sometimes they ask me to collaborate with them.

Table 4 summarizes the findings of the use of the Internet for networking.

	University of Indonesia n=7-9	Syiah Kuala n= 8-10	IAIN n=5
Cooperation and networking			
Cooperation with international partners	78 %	30 %	0 %
Contacted strangers for research purposes by email	86 %	33 %	0 %
Been contacted by strangers for research purposes by email	75 %	22 %	0 %

Table 4 The Internet used for networking

5.5 Obstacles to efficient usage of the Internet

As one of the objectives of this study is to propose measures that can improve the efficiency of researcher's Internet use, this section presents what are identified as the main obstacles for each of the universities. The obstacles are then analyzed in light of the circle of knowledge processes (figure 1).

At the University of Indonesia it was found that both ICT infrastructure and content provision (subscription to e-journals) is satisfying. As a *regional center* the university has more financial resources than most other universities in the country. The most pressing issue lies on an individual level: important differences in use of the Internet depending on age were revealed. A second factor hindering efficiency is a lack of web-publishing; few respondents publish their research on the Internet.

At Syiah Kuala University organizational factors have important impact on researchers' use. With no subscription on e-journals, access to the current research is complicated. Furthermore, there is an important gap between different faculties. Faculties from natural sciences tend to have both more bandwidth and higher penetration of ICT equipment than social sciences faculties. The reason for this appears to be that natural science faculties have a better *technological capability* and therefore can use their own staff for building and maintaining their own ICT infrastructure. In contrast the social science faculties depend on financial aid from the administration in order to employ dedicated ICT staff.

At IAIN Internet-access is inexistent, management shows little will to improve the situation and lacks finances to do so. Individuals lack motivation and skills in using the Internet, and lack of English skills would make it hard to benefit from international sites.

Looking from an organizational view, both *encoded* and *embedded* knowledge on efficient use of the Internet has to be improved. With the exception of University of Indonesia, there are few signs of formal initiatives for supporting knowledge acquisition, knowledge sharing and networking. At the UI knowledge acquisition through the Internet is supported through subscription to electronic journals. Knowledge sharing through the Internet is less supported (two exceptions are faculty online journals and one single department's blog initiative). Similar organizational efforts were not identified at Syiah Kuala. However, there are ad-hoc solutions building up Internet networking: Yahoo-groups. As it is not a formal initiative, it can be classified as embedded organizational knowledge. With these few exceptions the

interviews reveal a systemic lack of organizational efforts to increase both encoded and embedded knowledge regarding efficient use of the Internet for knowledge processes.

The consequences of this have an impact on the circle of knowledge processes (figure 1). At University of Indonesia sharing is limited - especially in the national language. This might have a negative impact on the building of national research co-operation and therefore one risk to overlook national capacities. In this regard, the University of Indonesia fails its role as a *regional center* because it does not facilitate less privileged universities' access to their knowledge base. At Syiah Kuala both acquisition and sharing of knowledge is limited. Therefore, it is likely that the production of knowledge is inefficient as 1) much time must be used just to get access to research articles and 2) networking will suffer as a result of lack of visibility due to limited web-publishing. IAIN is practically isolated from the virtual world, take little benefit of the Internet's potential to increase access to knowledge, to publish their own research or to build research networks.

5.6 What factors influence the researchers' use of the Internet?

The pattern of Internet use varies greatly between the 25 respondents in this investigation, from extensive, state of the art use, to non-use. To further analyze this difference I will put forward three archetypical kinds of users: advanced-, basic- and non-user.

In the boxes 1, 2 and 3, three researchers are presented. They represent a non-user, an advanced user and a basic user.

A lecturer of demography at Syiah Kuala University

"When a physical barriers become the obstacle …"

"Megawanti" is the oldest respondent interviewed, she is 64 years old. Her educational background is a Bachelor degree from Syiah Kuala. Since 1971 she has been working at the Faculty of Economy. She has an important production in demography and in women studies. Through the Center of Women studies at Syiah Kuala, Megawanti has a close cooperation with institutions in Java. This cooperation also gives access to recent literature in her fields of study. Due to an eyesight problem, she has difficulties to use a computer. Still she thinks the Internet can be very supportive for research and writing processes. Indeed, she has asked her daughter to help her search for research material on the Internet, and occasionally she gets information from the Internet from her students. It is obvious that she is very interested in the opportunities given by the Internet as the following statement show:

> … in PSW [Women Studies Center], I organized Internet training for PSW staff, we invited people as trainers, I did not attend it, I asked my husband to join it instead. My eyes cannot see clearly, it is blurring, I am not even able to see the keyboard of the computer…

Box 1 An example of a non-user of the Internet

A physics researcher at University of Indonesia

"The zeal of knowledge and technology…"

Researcher UINS 3 (41 years old), hereafter called Taufik is a highly energetic and enthusiastic man. After finishing a bachelor degree, he continued his studies in Europe where he finished a PhD. Later he had a Post Doctoral year in the USA. His first use of the Internet was at the university in Europe in 1991 when he used email to communicate with his second supervisor in the USA. He learnt to use the Internet by himself and with the help of friends. His use of the Internet for knowledge acquisition is targeted, concentrating on two information sources: Physical Review from the American Physical Society and Los Alamos open. Still he feels overwhelmed with the amount of information:

> Of course [the Internet] has a negative side. Within one day I could have 200 abstracts of papers (…) it needs to be specialized. I have no time for the whole archive.

He is well aware of open access initiatives, but explains that the main problem is that the articles there are not of the highest quality. English is the main language when searching for information on Internet, but sometimes he use German when he is looking for old classic articles. Previously he has ordered books through Internet, but he says he does not feel comfortable with the security for payment.

He publishes in several world leading journals within his field and also in Los Alamos open archive. When asked about copyright issues when publishing in both academic journals and open archives, he explains that he "do not really care about copyrights" and says that he considers what he publish in open archives as preprints. Taufik never publish in Indonesia "because there is no many physics working in this field".

He uses Internet extensively for communication and building networks – "99 percent [of my communication] was through Internet". He is also one of few respondents that have made new and lasting contacts with people he met through Internet

> I met people whom I never met before through Internet. I met several people abroad, those whom I never met before, through Internet. Mostly, it was started because of their interest in my job (…) At the end sometimes they asked me to collaborate with them. (…) I get really advantage from Internet. I was invited by people in South Africa to come there.

Box 2 An example of an advanced user of the Internet

A lecturer of religion at IAIN

"Access vs. necessity …"

"Zuhra" teach Islamic education at the Institute for Islamic Studies. She studied Islamic Education at IAIN in Banda Aceh where she got her bachelor degree, before she continued to take her masters degree in Malaysia focusing on educational administration. She first used the Internet when she studied in Malaysia. She could have used the Internet in Banda Aceh before that, but "you had to pay and the place was quite far (…) so it was difficult for us". There are no computers accessible for her or her colleagues at the university. Before the tsunami she could use her husband's laptop and a dial-up connection from home. After the tsunami struck the fixed line telephone system is replaced by a wireless telephone system, and she can not afford to use the Internet from home any more. Now she has to go to her husband's office in order to use the Internet. She typically looks for reading material to be used in class; she says the textbooks available in the university are not suitable for the level of the students. In order to get promoted she has to publish research articles in the faculty journal. But as she says

> "most of [the] lecturers here have rarely used an article from the Internet, we use the journals available here."

Box 3 An example of a basic user of the Internet

Inspired by these three interviewees with distinctive patterns of Internet usage, a classification of three groups of users are presented in the following sections: the advanced user, the basic user and the non-user.

5.6.1 The advanced user

It is likely that the high number of researchers that have studied abroad influence on the pattern of Internet use as these comments indicate:

> "I used Internet a lot [for research in Birmingham] so when I came back here, not using for one day, I started to miss something. … I had to go to Warnets [Internet cafés] I had to go there every day, stay one or two hours." SKNS4

> "When I came back from Japan, we were very angry to the university, why you do not support Internet …" SKNS3

This observation is also confirmed by Daoud (2000) who noted that the pioneers of Internet use in Banda Aceh, were mostly those who had just completed their studies overseas. "The academics believed that they needed to maintain access to the Internet, as they did overseas, to communicate with their colleagues and professors and follow the latest developments in their fields" (Daoud, 2000, p. 127)

Indeed the advanced user has generally postgraduate studies from the US, Europe or Japan (but it is not always so). The time spent abroad motivated him/her to use the Internet for several reasons. First of all, the Internet proves an efficient and cheap way to communicate with colleagues, supervisors and others at home. In many cases the only way to get news from home is through the Internet as respondent IAIN1 says: "I was clever to use Internet … because I needed information regarding the news from home."

Also, as more resourceful universities have electronic subscriptions to academic journals, these users were encouraged to support their research with updated articles from the Internet and made such use a habit. Finally, returning to Indonesia it is natural to stay in contact with their colleagues at the university they were staying, and this is most easily done through the Internet. This shows that the pattern of use of the Internet is highly influenced by previous use of the Internet. (But as already mentioned, previous use does not guarantee continuous use; a prerequisite for many is a convenient access to the Internet from their office environment.) Furthermore, some of the respondents never studied abroad; still they have developed advanced user patterns. It is observed that those have developed such skills through a strong personal motivation, driven by their own curiosity. They have had help from colleagues and friends to acquire skills, but there has been little or no encouragement from their organization.

The advanced users are systematic in their search for information, and prefer to use a few reliable sources. Few publish their research on the Internet by themselves, but they work will often be web-published by international journals that have accepted their articles or by arrangers of congresses that web-publish their proceedings. They correspond regularly with international contacts through email, but consider email less suitable for communication within the country.

5.6.2 The basic user

The basic users have learnt to use the Internet by themselves and with help of friends and colleagues. They have realized that valuable information can be found on the Internet.

Their motivation has been their own curiosity. They feel discouraged by technical limitations and troubles, and hesitate to be too dependent on the Internet for the same reason.

The basic users search for information less systematically, typically using Google or Yahoo as an entry point. While advanced users are focused on specific community and use their Internet services to keep updated about research in their field, basic Internet users start from scratch searching the whole Internet every time they look for information.[36] They use information from the Internet more for teaching purposes than for research. They do not publish themselves on web, but share material from the Internet with their students in lectures and as paper or softcopies. Communication by email is more the exception than the rule, it is used when face to face meeting is impossible and telephone too expensive.

5.6.3 The non-users

The non-user can be divided into two groups: the older generation and people with difficult access to the Internet.

Elderly people (about 50 years and above) explained that they lacked motivation and that they were too old to learn something new, especially new technology. Physically they

[36] This observation is confirming the view of Ernst and Lundvall's (1997) description concerning the new tacit skills required in a learning economy.

often have difficulties, particularly with their sight. They also explained that they rarely got possibilities to do further studies abroad, the younger staff is given priority. Nevertheless, they are well aware of benefits of the Internet and support their entourage in using it as the following citations show:

> "We are obliged to encourage students to use the Internet to get actual information, though I do not use it myself. And I ask them to give a copy for me." (SKSS4)

> "I could not find [information] on the Internet myself, and I see it as my weakness. My eyesight … is my limitation. I am old now, 64 years old." (SKSS5)

These two respondents are part of the group that several respondents referred to as non users: the elderly people – and it is an example of a digital divide that can happen within one working place. This finding supports the view of Arocena and Sutz (2003) discussed in section 4.1: Elderly people have not got necessary training to adapt the new technology, a *learning divide* exists between the younger and elder generation.

On the other hand, researchers belonging to the younger generation who have used the Internet in the past might have become non-users now due to lack of motivation and access. Despite the fact that Internet cafés are widely available in Banda Aceh by now, academic staff at IAIN does not seem eager to exploit the Internet. Says respondent IAIN5:

> [I have] no motivation from myself or the surroundings … When I see my friends here in this university, some never use the Internet, some seldom use the Internet.

With no incentives or motivation from management level, and without a convenient access to the Internet, even researchers that have been using the Internet during their studies, hesitate to make use of the Internet again.

5.6.4 Studying abroad[37] and transfer of technology

From the interviews, it is striking to see how many respondents that have studied abroad (61%), and also how important such exchange seems to be when it comes to improve the efficiency of use of the Internet. In this section a closer look on the consequences of such exchange is offered.

Academic staff that has been abroad brings back their new habits of Internet use to their university. If the infrastructure is weak, they tend to push the management to improve it. This way they are taking part of a *technology transfer*. Equally significant, they bring back a behavioral pattern and skills on how to use the technology. Additionally, they themselves are important resource persons while staying abroad, in that they can help colleagues to download articles from academic journals free of charge and send them home. Furthermore, when they are back, the established contacts overseas will serve as

[37] The question of brain drain (the phenomenon of migration of qualified people from the South to the North) arises when academic staffs study or work overseas. When asked, none of the respondents felt this as a problem. Says respondent SKNS5: "… [brain drain] is good, it is ok as long as not 90% of our lecturer go there … if they get a higher offer and stay there, that's ok we just appoint another junior." Having ex-staff employed in foreign countries is actually mentioned as an advantage. Respondent SKNS5 explains: "One of our alumni now became professor in the US, he helps us very much, if difficult to contact other scientists overseas, then we email him and he will recommend us." For any country, having invested in a higher education for its citizens, the motivation is in getting later benefits economically or otherwise. But that a citizen emigrates does not mean that those benefits disappear. As we have seen emigrated researchers open an effective channel to survey research around the world. This requires frequent communication, and the Internet can provide the necessary infrastructure for this.

their source for the latest articles. Finally, the former supervisors often remain the main collaboration partner overseas: a strong relationship is established and with the help of the Internet, communication can continue smoothly.

5.6.5 When the Internet is not easily accessible…

By including IAIN in the study, several factors that impede the use of the Internet were revealed. In this section it is discussed how the differences at IAIN have an impact on the academic staffs' usage of the Internet.

The situation with regard to ICT resources at IAIN compared to the other universities is quite different. With no computers for the researchers (except personally owned computers), and no Internet connectivity at the university, the only way to use the Internet is to go to the *warnets*. The findings from IAIN revealed that even users with previous experience with the Internet, stopped or reduced their use of the Internet when it was not easily accessible for them anymore. Respondent IAIN5 explains:

> "It is hard to do it again now. No motivation from myself or surroundings. Family is also an obstacle. We have to have the Internet here to be motivated to do it."

Lecturers that have used Internet during their studies, complain that they forget how to use the Internet because they use it so rarely:

> "…something that we lost for a long time is hard to be gained. Even a computer, sometimes I do not know how to operate the computer." (IAIN3).

Easy access to the Internet is for many researchers a requirement in order for them to use it. At IAIN a lack of convenient access to the Internet hinders the academic staff to use the Internet for professional communication.

5.6.6 Influence of local culture

A few cultural factors are worth to be commented on, even though only mentioned by a few respondents, since it depicts the local context's potential impact on Internet use.

Among the interviewees there were no clear indications of gender unbalance in the use of the Internet. However one female respondent (IAIN5) informs that it is not common for women to go alone to an Internet café.[38] She says it is more comfortable to go with friends. This indicates that for women researchers a convenient access to the Internet on the workplace is even more important for women than for men in this particular context.

Another respondent (IAIN2) mentioned the danger in letting students browse on Internet, that they can come across "bad content", and that it would be better that the lecturers provided them with filtered information from the Internet. Although this mindset might be found among some Islamic conservatives in Banda Aceh, it was not supported by any of our other respondents.[39] Head of ICT department at Syiah Kuala told about initiatives towards religious leaders hesitating to use the Internet.

> I have invited them to seminars to search for information about al Koran. I explain that the Internet is like a blank piece of paper, you can draw whatever you want to, from pornography to verses from the Koran. They seem to enjoy finding information about the Koran from all over the world. (FJ)

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[38] In Banda Aceh, some spaces like for example coffee shops are practically reserved for men. The researcher's observations do not indicate that the same is the case for Internet cafés, but it is true that it is rarer to see a single woman than a single man visiting an Internet café.

[39] Still, the responsible for the computer room at one faculty at Syiah Kuala explained that the set-up of computers where intentionally done so that any "bad content" displayed on the screen would be easily seen by other users and the tutor.

This is a clear example of a conscious act to encourage spread of new technology. Introduction of new technology demands negotiation with the local culture, and obstacles will be different from culture to culture. The strong position of religion in the Acehnese society has challenged the diffusion of the Internet in the universities of Banda Aceh (Daoud, 2002), but this research suggests that the skepticism towards the Internet in the university environments now has been overcome. In an interview Daoud describes earlier negotiations:

> It has changed. It was very closed. … in IAIN and actually at Syiah Kuala University too. Later on … they see that [the Internet] is very important. But first you know, the negative impact was very highly propagated. So people said that this is no good. This can be very bad for the morality of our young people. But later on when they see: this is not only for negative thing … we can also have a lot of positive thing. So people begin to realize it is important. They see the fact. They have access to information they never could have before. … [B]efore, they only know Internet access about pornography or whatever. But now they see. Especially now they have this Internet, I say that if you do not want this website you can have the security program, no problem. I was challenged that question quite many times and I said if you do not want that you can just close that one… Depending on what you want, yes. Like when you are in a foreign country. Here … you can not find bad things, but if you are in a foreign country with different cultures, you can find this. But who protect you? You yourself. Ok so this is the era of globalization. Who should protect you? You yourself. And to me, if you ask me frankly - if you have been educated, you are strong religiously and socially you should not be influenced. But if you are weak, even if people do not influence you, you can be influenced. (DD)

5.6.7 Summary

As observed, the pattern of use of the Internet varies greatly from user to user. Even when two users have similar access to the Internet, the intensity of their use is different. The type of use depends on their field of interest, their familiarity with the technology, their language skills, their previous experiences with the Internet and their proximity to ICT facilities. The way of using the Internet is not pre-determined once the connectivity is there, but varies a great deal from individual to individual. Strikingly, some researchers

do not use the Internet at all, while others at the same university say they can not live without it.

The users motivation can be different, his or her previous exposure to the Internet clearly matters, and age, gender and local context are also influencing the use of the Internet. The findings show that obstacles are imposed from an individual level, and an organizational level.

Figure 2 summarizes the factors within the individual that were found to influence the researchers' use of the Internet in important ways.

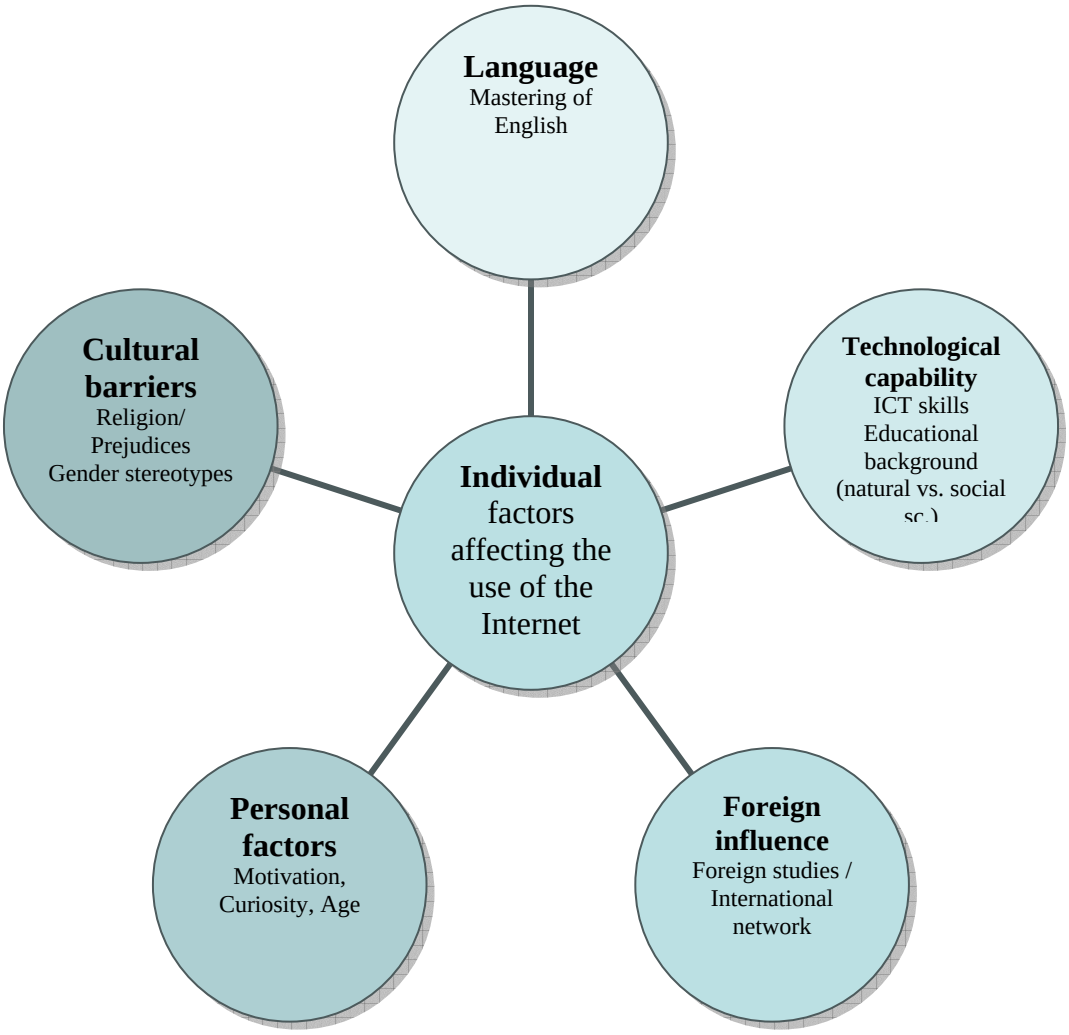

Figure 2 Factors affecting the use of the Internet - individual level

From the interviews, various factors that influence on Internet use on an organizational level can be extracted (figure 3). Those factors ultimately influence on the individuals use of the Internet. The factors include economy, management, technological capability, cooperation and own staff. As those factors will vary from university to university, so will the use of the Internet. This shows that the use of technology take place in a seamless web of a wide range of factors.

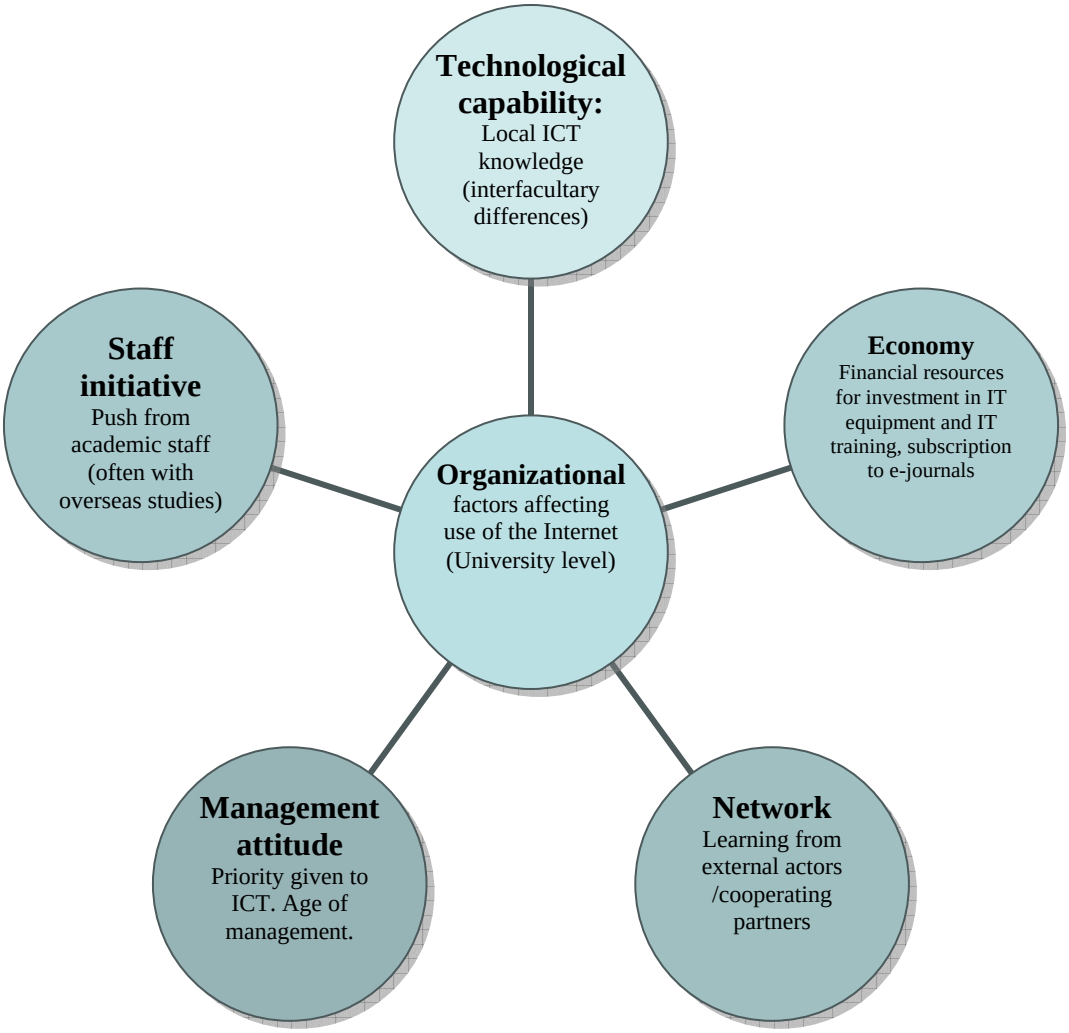

Figure 3 Organizational factors influencing a researcher's use of the Internet

For the sake of completeness a last figure (figure 4) shows external factors that a university has little or no influence on. In addition to factors that have already been discussed, two issues have been added: political situation and emergencies. In the case of Aceh where there has been political instability for decades, development has been slow and institutions of higher education have suffered from lack of economic resources and insecurity. After the Tsunami in 2005 however, international attention and support has completely changed the situation. This attention led to a peace agreement between the government and the *Free Aceh Movement* (GAM) that was signed in August 2005. A well of resources have been channeled to the area, ICT infrastructure is improving and cooperation between UN agencies, NGOs and the universities has been flourishing. In this situation, the challenge is to prepare for sustainable solutions that can secure a higher standard of learning for the next decades.

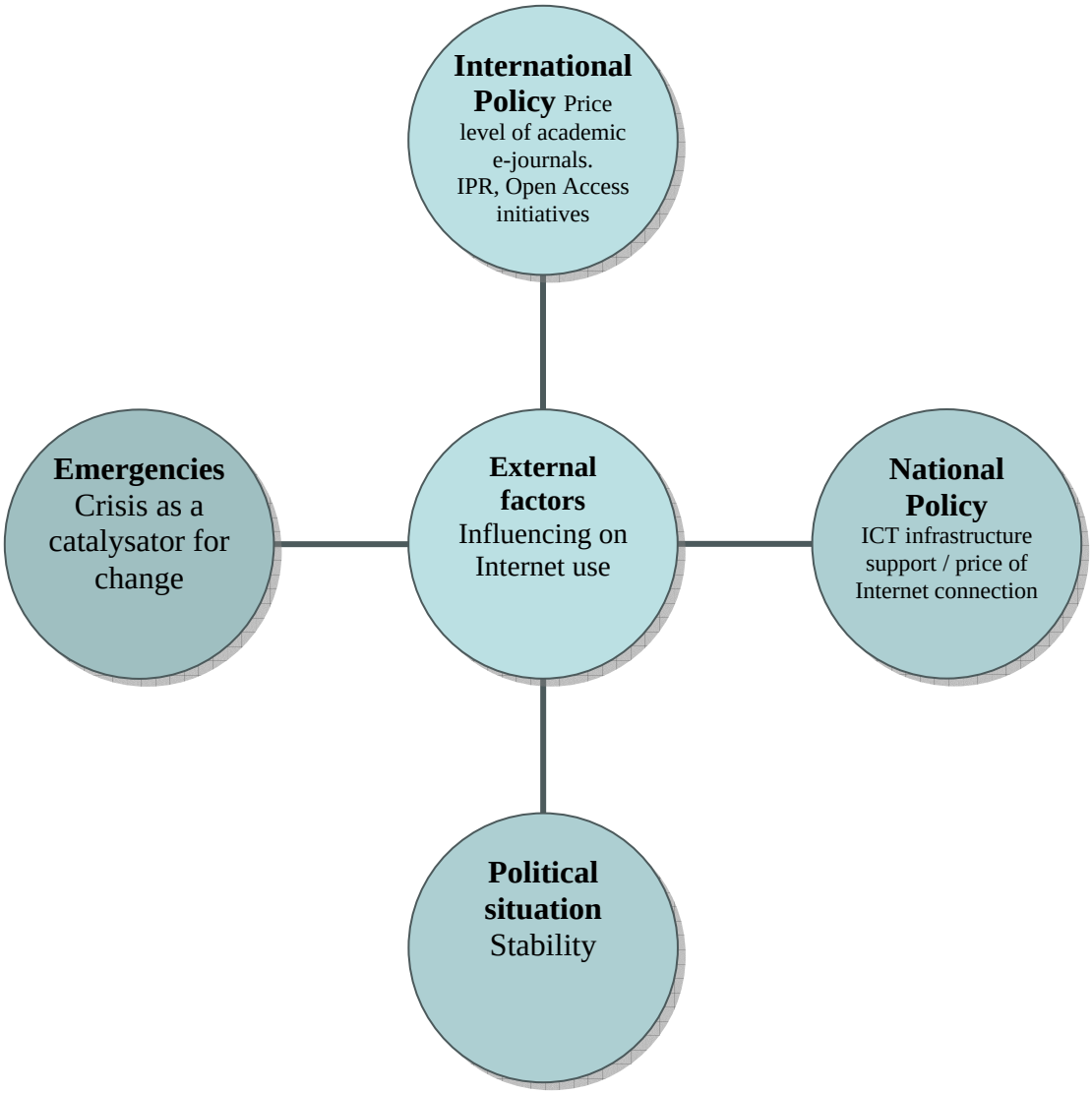

Figure 4 External factors influencing on the Internet use

6 CONCLUSION

To be fond of learning is to be near knowledge.

Confusius

Higher education is a fundamental element of the knowledge society. Developing countries striving to catch-up are aware of the role universities can have as an instrument in innovation policy.[40] However, this thesis illustrates the statement by UNESCO presented in section 4.1.[41] Lack of ICT infrastructure, digital divides, the phenomenon of 'brain drain' and both linguistic and cultural barriers have indeed been identified throughout the study.

In this final chapter the findings will be summarized, and based on those, recommendations for ICT policy at the institutions under investigation and suggestions for further studies are presented.

[40] See for example Mowery and Sampat who write: "[A] growing number of industrial-economy and developing-economy governments seek to use universities as instruments for knowledge-based economic development and change ... [Among important themes in research on innovation processes] is the reconceptualization of universities as important institutional actors in national and regional systems of innovation" (in Fagerberg et al 2005 p. 210)

[41] Here repeated for the readers' convenience. "[The challenges regarding education in developing countries are] the obsolescence of existing infrastructures, the decline of the quality of higher education, the underdevelopment of research infrastructures, the 'brain drain' towards the wealthy countries, the digital divide, the linguistic and cultural barriers, the reduction of state funding and, in certain cases, the lack of genuine public policies in this field." (UNESCO 2005 p.97)

6.1 Summary of findings

6.1.1 How do researchers use the Internet?

The first research question was “In what way is the Internet involved in a researcher’s knowledge acquisition, knowledge sharing and creation and maintenance of a professional network?” Here follows what the study found:

Articles from payable academic e-journals are the most valuable source of information for the researchers using the Internet in this study. However, only University of Indonesia affords to subscribe to such journals, and even there each faculty can subscribe to only a few of them. Therefore the researchers depend on colleagues overseas to download and send articles needed. Open Access journals exist as an alternative to payable journals, but the study shows that the use of those is rare. Even though almost half of the respondents know about Open Access journals, only one out of ten respondents makes use of them. Know-when and know-where knowledge in the form of information about seminars and congresses is seldom found directly on the Internet. Only after such information has been acquired from a social network or an advertisement, the Internet is used as a complementary source for such information.

Few of the researchers interviewed have published their work on the Internet (about 15%). Lack of technical skills and also a fear of exposure of their work are among the obstacles for web-publishing. Yet, a higher number (about 35%) have had their work web-published by others (for example in journals). The majority of the respondents use English when searching for scientific knowledge on the Internet, and this can be seen

partly as a consequence of a general lack of initiatives supporting web-publishing in the Indonesian language. This thesis argues that the limited use of the Internet for sharing own research work is unfortunate for two reasons. Firstly because there is a lack of research work on the Internet in the Indonesian language and researchers with limited English skills are depending on Indonesian researchers' web-publishing to benefit from the Internet for knowledge acquisition. Secondly the researcher looses an opportunity to expose his or her work, and an exposure on the Internet could have improved his or her chances for increasing the researchers' network.

The Internet is much used for communication among researchers with convenient Internet access. Email is the preferred means of communication with international contacts, but locally telephone and face to face meetings are dominating. One reason for this is many users' infrequent check of their email accounts. Mailing lists are appraised differently from one university to another. While UI respondents are annoyed by the amount of messages in mailing lists, respondents at Syiah Kuala University consider local mailing lists as very valuable source of information and as an important way of staying in contact. The study shows that only in exceptional cases longer lasting professional contact is established online. However, the Internet can play an important role in maintaining and strengthening a relationship once it is established through a physical meeting.

6.1.2 What factors influence the researchers' Internet use?

The second research question was "What are the factors influencing on a researcher's use of the Internet seen from an individual and organizational point of view?" The case study reveals that the use of the Internet differs significantly from one researcher to another. Additionally it shows that the use of the Internet varies between groups of researchers and also from one university to another.

A number of factors have been identified influencing researchers' use of the Internet. On an individual level, the most important factor increasing Internet use seems to be study or research stays in an overseas university. On the opposite side, high age is the factor that mostly limits its use. Elderly people lack training in the use of ICTs, and also sometimes suffer from physical disabilities hindering the use of computers. Finally it has been observed that the most productive researchers have a more advanced user pattern than less active researchers. Their eagerness and curiosity in their work also become apparent in the way they use the Internet. They are the ones that despite inconvenient access to the Internet, manage to get relevant information, communicate across borders and share their knowledge in the virtual world.

The researcher's surroundings evidently influence on the use of the Internet. A lack of convenient access to the Internet is the strongest negative incentive identified. Indeed, a lack of convenient access to the Internet has dramatic consequences on Internet use; in this situation even researchers with previous use of the Internet tend to become non-users.

When the university administration gives no priority to ICT, it creates an atmosphere where only researchers with strong personal motivation explore the opportunities the Internet is giving. The main factor behind such a priority is the cost related to ICT investments. However, these costs must be seen in light of the cost of limited access to knowledge, lack of visibility in the virtual world and less opportunities for cooperation that are the consequences not using the Internet. (Furthermore the costs of having students with limited ICT skills as future employees in local government, the educational system etc have must be considered.)

An absence of formal training in the use of the Internet is not visibly hindering its use, as most respondents inform that they have learnt by themselves or through colleagues and friends. Still, by observing the gaps in efficiency of the use of the Internet among respondents, it is clear that training in Internet skills could be highly profitable.

6.2 Recommendations for universities' ICT policy

The case study has shown that the challenges and opportunities for the use of the Internet in higher education have to be thoroughly analyzed, both on an individual and institutional level (see figure 2, 3 and 4 in chapter 5). Hence, any intervention aiming to boost the appliance and usefulness of the Internet in this context, must consider the challenges on several levels.

On individual level trainings on Internet search methods, publishing skills and on general awareness about the variety of sources on the Internet should be conducted. Due to the

dominance of English sources at the Internet, English language training for all university students should be introduced.[42]

The study reveals that most important source of information for research purposes is articles in payable academic e-journals. The fact that the universities' economy only allows a few, if any, subscriptions of journals in a given field makes the researchers depend on contacts at more resourceful universities overseas. My recommendations on organizational level in this regard are: Continue international exchange of students and researchers in order to extend the international network. Arrange for ministry level negotiations with publishing houses in order to achieve affordable prices for all Indonesian universities.[43] At the same time Open Access archives should be established in the national language, where also translations of foreign articles should be encouraged. The universities should have a conscious approach to the use of the web for publications and facilitate for web editions of faculty journals and on a longer term establish inter-university thesis databases.[44] This study shows that convenient access to the Internet is of high importance. Therefore, as far as the economy allows, a continuous expansion of the number of computers and an increasing bandwidth should be planned for.

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[42] Indeed, several researchers from both social and natural sciences told that they had a focus on improving English skills, through for example having slide-shows with English text.

[43] An important argument in such negotiations is that the alternative of affordable prices, is a continuous practice of having sent articles from contact persons at universities overseas with a result that the publishing houses do not have any income at all.

[44] The chemical department at the University of Indonesia is already working on such a database in association with the national chemical association and other universities (SKNS4)

6.3 Recommendations for further studies

From this exploratory study a number of topics that can be focused on in further research have been revealed.

- This research shows that Open Access initiatives are not much used. What factors influence the effectiveness of Open Access initiatives?
- Elderly people have been identified as non-users of the Internet. What are the consequences of this? What can be done to avoid this digital divide?
- Few researchers publish their works on the web in the national language. Further investigation of the use of the Internet for sharing research work should be done.
- This study has revealed that factors related to local context may have an influence on the use of the Internet. Follow up studies can focus on gender perspective and impacts from religion and local culture.
- In order to increase the understanding of how the Internet is used in Higher Education, a similar study on students' use of the Internet should be done.

Furthermore quantitative studies aiming to confirm conclusions of this work should be conducted.

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ATTACHMENT 1: LIST OF INFORMANTS

Code	*Age*	*Position*	*Faculty*
UI NS 1	37	Lecturer, Pharmacy	Faculty of Natural Sciences
UI NS 2	ca 35	Lecturer, Physics	Faculty of Natural Sciences
UI NS 3	41	Lecturer, Physics	Faculty of Natural Sciences
UI NS 4	36	Head of Research and community contact	Faculty of Natural Sciences
UI NS 5	48	Head of Department of Chemistry	Faculty of Natural Sciences
UI SS 1	ca 45	Lecturer, Political science	Faculty of Social and Political Science
UI SS 2	ca 35	Lecturer, Head of undergraduate program	Faculty of Social and Political Science
UI SS 3	31	Lecturer Philosophy Department	Faculty of Humanities
UI SS 4	ca 35	Lecturer Woman's rights	Faculty of Humanities
SK NS 1	32	Lecturer, physics	Faculty of Natural Sciences
SK NS 2	34	Head of Department, mathematics	Faculty of Natural Sciences
SK NS 3	39	Vice Dean for Cooperation Affair/Physics lecturer	Faculty of Natural Sciences
SK NS 4	40	Head of Department, Chemical Engineering	Faculty of Engineering
SK NS 5	39	Lecturer, Chemical Engineering Department	Faculty of Engineering
SK SS 1	43	Vice Dean for Cooperation Affair/law lecturer	Faculty of Law
SK SS 2	34	Lecturer, accounting	Faculty of Economics
SK SS 3	ca 50	Lecturer, accounting	Faculty of Economics
SK SS 4	64	Lecturer, head of extension program	Faculty of Economics
SK SS 5	64	Lecturer, demography	Faculty of Economics
IAIN 1	31	Lecturer, hadits / Islamic interpretation	F-Dakwah
IAIN 2	ca 30	Lecturer, counseling department	F-Dakwah
IAIN 3	35	Lecturer, English and education	F-Adab / Islamic civilization
IAIN 4	35	Lecturer, fiqh / Islamic tradition, communication	F-Dakwah
IAIN 5	33	Lecturer, communication	F-Dakwah

Codes

UI University of Indonesia, Jakarta

SK Syiah Kuala University, Banda Aceh

IAIN Islamic State Institute, Banda Aceh

SS Social Science

NS Natural Science

ATTACHMENT 2: LIST OF INFORMANTS FOR SECONDARY DATA

Date of interview	Initials	Name	Position	University
June 7th , 2006	A	Aryanto	IT technician, ICT department	University of Indonesia
June 7th, 2006	M	Mariyah	Librarian, responsible for academic journals	University of Indonesia
June 21st, 2006	J	Drs Jafar	Librarian, section of journals	Syiah Kuala
June 19th , 2006	FJ	Fajri Jekfar	Head of *Puskom* (ICT department)	Syiah Kuala
June 16th , 2006	DD	Darni Daoud	Rector	Syiah Kuala
June 15th, 2006	LI	Lukman Ibrahim	Vice rector	IAIN

ATTACHMENT 3: INTERVIEW GUIDE

1) Interviewee background
    a) Contact details
    b) Education history
    c) Job history
    d) Age

2) Use of Internet – history
    a) When and where were you first introduced to Internet?
    b) How did you learn to use Internet?
    c) Did you attend any course in information seeking etc on Internet?
    d) How have your previous experiences influenced on your use of Internet?

3) Acquiring information
    a) What kind of information do you look for on Internet?
    b) Where do you look for information on Internet?
    c) What sources on Internet do you use for information gathering?
    d) How do you evaluate the quality of what you find on Internet?
    e) What do you see as obstacles when looking for information?
    f) What languages do you search for information on?
        i) Bahasa
        ii) English
        iii) Other languages

4) Acquiring information II – Open Access, Library
    a) Have you heard about open access archives and open access journals?
        i) if yes, did you use these sources for information seeking?
        ii) if yes, did you publish own work in this journals?
    b) When and how do you use the library?
    c) What journals do they subscribe to
        i) in paper copies
        ii) electronically

5) Sharing knowledge
    a) Who have interest in what you do research on?
    b) Where do you publish your articles?
    c) Is any of your work available on Internet?

d) Do you use material from Internet in your classes? How?
e) Do you share information from Internet with the local community?
f) What do you see as obstacles for sharing information through the Internet?

6) Networking I
   a) For your research, who are you cooperating with?
      i) Did you have co-authorship of articles with any of them?
   b) Who are your main collaboration partners
      i) locally
      ii) regionally
      iii) internationally
   c) How do you communicate with them?
   d) How many researchers from outside the university do you have contact with weekly?
      i) by telephone
      ii) by the Internet
      iii) by other means

7) Networking II
   a) Do you participate in mailing lists?
      i) If yes, what kind of mailing lists?
   b) Have you made new professional contacts through Internet?
      i) If yes, how did you become aware of their work?
      ii) If yes, through which applications did you communicate?
      iii) If yes, have this led to further communication?
   c) How can people reach you?
   d) Have you been contacted through Internet by unknown researchers?
      i) If yes, has this led to further cooperation?
   e) What do you see as obstacles when taking and keeping contact through Internet?

8) Teaching
   a) How is Internet use integrated in your teaching?
   b) What is your impression of students' use of Internet?

9) Other Internet use
   a) Did you benefit of information about vacancies, grants, scholarships that you got information about through Internet?
   b) Did you go to congresses, seminars etc that you learn about through Internet?

c) Did you order books from Internet?
d) Did you subscribe to any journals?

10) Internet – future
a) How do you imagine/expect/hope the Internet use at your institution will develop in the next three years?

ATTACHMENT 4: MAP OF INDONESIA